

TOTAL MAXIMUM DAILY LOAD (TMDL)
For
Siltation and Habitat Alteration
In The
Clear Fork River Watershed (HUC 05130101)
Campbell, Claiborne, and Scott Counties, Tennessee

FINAL

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LIST OF ABBREVIATIONS

ADB	USEPA/TDEC Assessment Database
ARS	Agriculture Research Station
BMP	Best Management Practices
CFR	Code of Federal Regulations
DEM	Digital Elevation Model
EFO	Environmental Field Office
GIS	Geographic Information System
HUC	Hydrologic Unit Code
LA	Load Allocation
MGD	Million Gallons per Day
MOS	Margin of Safety
MRLC	Multi-Resolution Land Characteristic
MS4	Municipal Separate Storm Sewer System
NED	National Elevation Dataset
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resource Conservation Service
NRI	National Resources Inventory
RM	River Mile
RMCF	Ready Mixed Concrete Facility
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil and Geographic Database
STP	Sewage Treatment Plant
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
TDA	Tennessee Department of Agriculture
TDEC	Tennessee Department of Environment & Conservation
TDOT	Tennessee Department of Transportation
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids

LIST OF ABBREVIATIONS, Cont.

USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WCS	Watershed Characterization System
WLA	Waste Load Allocation
WWTF	Wastewater Treatment Facility

SUMMARY SHEET

CLEAR FORK RIVER WATERSHED (HUC 05130101)

Total Maximum Daily Load for Siltation/Habitat Alteration in Waterbodies Identified on the State of Tennessee's 2006 303(d) List

Impaired Waterbody Information:

State: Tennessee

Counties: Campbell, Claiborne, and Scott

Watershed: Clear Fork River Watershed (HUC 05130101)

Watershed Area: 333.0 mi²

Constituent of Concern: Siltation/Habitat Alteration

Impaired Waterbodies: 2006 303(d) List

Waterbody ID	Impacted Waterbody	Miles/Acres Impaired
TN05130101016_0100	White Oak Creek	6.7
TN05130101091_1000	Elk Fork Creek	3.9

Designated Uses: Fish & Aquatic Life, Recreation, Livestock Watering & Wildlife, and Irrigation. Some waterbodies in watershed also classified for Trout Stream and/or Domestic Water Supply (TDEC, 2004).

Applicable Water Quality Standard: Most stringent narrative criteria applicable to Fish & Aquatic Life use classification.

Biological Integrity: The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.

Interpretation of this provision for any stream which (a) has at least 80% of the upstream catchment area contained within a single bioregion and (b) is of the appropriate stream order specified for the bioregion and (c) contains the habitat (riffle or rooted bank) specified for the bioregion, may be made using the most current revision of the Department's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys and/or other scientifically defensible methods.

Interpretation of this provision for all other streams, plus large rivers, reservoirs, and wetlands, may be made using Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (EPA/841-B-99-002) and/or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to

appropriately selected reference sites in the same bioregion if upstream conditions are determined to be degraded.

Habitat: The quality of instream habitat shall provide for the development of a diverse aquatic community that meets regionally based biological integrity goals. The instream habitat within each subcoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.

TMDL Development

Sediment Loading Analysis Methodology:

- Sediment loading analysis was performed using the Watershed Characterization System Sediment Tool (based on Universal Soil Loss Equation (USLE)) applied to impaired HUC-12 subwatershed areas to calculate existing sediment loads.
- Target sediment loads (lbs/acre/year) are based on the average annual instream sediment load from biologically healthy watersheds (Level IV Ecoregion reference sites).
- The percent reduction in average annual instream sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate target load was calculated.
- 5% of subwatershed target loads are reserved to account for Waste Load Allocations (WLAs) for Ready Mixed Concrete Facilities (RMCs) and regulated mining sites. Although there were no RMCs in the Clear Fork River Watershed as of October 10, 2007, the 5% allocation addresses current and future mining sites and RMCs. Most loading from these sources is small compared to total loading. Since the Total Suspended Solids (TSS) component of Sewage Treatment Plant (STP) discharges is generally composed of primarily organic material and is considered to be different in nature than the sediments produced from erosional processes, TSS discharges from STPs were not considered in the TMDL analysis (ref.: Sections 3.0 and 6.0).
- WLAs for National Pollution Discharge Elimination System (NPDES) regulated construction storm water discharges are expressed as technology-based average annual erosion loads per unit area disturbed.
- WLAs for Municipal Separate Storm Sewer Systems (MS4s) and Load Allocations (LAs) for nonpoint sources are expressed as the percent reduction in average annual instream sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate reduced target load (target load minus the percent reserved for RMCs, regulated mining sites, and CSW sites).
- Allowable daily loads were derived for precipitation induced loading sources by dividing the appropriate annual loads by the average annual precipitation in each impaired subwatershed.

Critical Conditions: Methodology takes into account all flow conditions.

Seasonal Variation: Methodology addresses all seasons.

Margin of Safety (MOS): Implicit (conservative modeling assumptions).

TMDLs

HUC-12 Subwatershed (05130101___)	Waterbody ID	Waterbody Impaired by Siltation/Habitat Alteration	TMDL *	
			Required Overall Load Reduction	Daily Maximum Load
			[% Reduction]	[lbs/ac/in. precip.]
0506	05130101091_1000	Elk Fork Creek	85.3	5.4
0603	05130101016_0100	White Oak Creek	33.8	5.3

* Applicable to instream sediment at pour point of HUC-12 subwatershed

WLAs for Construction Storm Water Sites and MS4s, and LAs for Nonpoint Sources:

HUC-12 Subwatershed (05130101___)	WLAs				LAs ^b	
	Construction Storm Water ^a		MS4s ^b		Required Load Reduction	Daily Maximum Load
	Annual Average Load	Daily Maximum Load	Required Load Reduction	Daily Maximum Load		
	[lbs/ac/yr]	[lbs/ac/ in. precip.]	[%]	[lbs/ac/in. precip.]		
0506	6,000	116.3	88.2	4.3	88.2	4.3
0603	6,000	115.6	46.3	4.3	46.3	4.3

a. Value shown is allowable erosion from construction sites.

b. Applicable as instream sediment at pour point of HUC-12 subwatershed.

WLAs for regulated Ready Mixed Concrete Facilities and Mining Sites:

WLAs for NPDES permitted mining sites located in impaired subwatersheds are equal to existing permit requirements for these facilities. There were no RMCFs located in the Clear Fork River Watershed as of October 10, 2007.

Mining Sites Permitted to Discharge TSS and Located in Impaired Subwatersheds

HUC-12 Subwatershed (05130101___)	NPDES Permit No.	Name	TSS Daily Max Limit
			[mg/l]
0506	TN0042722	Mountainside Coal Co.	40
	TN0052493	W. H. Bowlin Coal Company (Tipple #1)	
	TN0066095	Elkview Land & Gravel Co.	
	TN0071714	Dewayne Rowe Logging & Coal (O'dell-Irish Co. Area #1)	
0603	TN0063576	Gatliff Coal Co. (White Oak Area #4)	
	TN0068918	Gatliff Coal Co. (White Oak Area #11)	
	TN0070963	Gatliff Coal Co. (White Oak Area #15)	
	TN0071145	Gatliff Coal Co. (White Oak Area #12)	

**TOTAL MAXIMUM DAILY LOAD (TMDL)
FOR SILTATION/HABITAT ALTERATION
CLEAR FORK RIVER WATERSHED (HUC 05130101)**

1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not attaining water quality standards. State water quality standards consist of designated use(s) for individual waterbodies, appropriate numeric and narrative water quality criteria protective of the designated uses, and an antidegradation statement. The TMDL process establishes the maximum allowable loadings of pollutants for a waterbody that will allow the waterbody to maintain water quality standards. The TMDL may then be used to develop controls for reducing pollution from both point and nonpoint sources in order to restore and maintain the quality of water resources (USEPA, 1991).

2.0 WATERSHED DESCRIPTION

The Clear Fork of the Cumberland River and Watershed are named for the clear spring-fed headwaters that form Clear Fork in a narrow limestone gorge in Kentucky. Clear Fork of the Cumberland River flows into Kentucky (where most of the watershed landmass is located) and is often confused with Clear Fork, a popular boating destination located entirely in Tennessee (and, with New River, forms the South Fork Cumberland River). The Clear Fork River Watershed, Hydrologic Unit Code (HUC) 05130101, is located in Kentucky and in Northeast Tennessee (ref.: Figure 1). The information (including figures and tables) presented hereafter in this document is for the Tennessee portion of the watershed only. The watershed includes parts of Campbell, Claiborne, and Scott counties in Tennessee. The Clear Fork of The Cumberland River Watershed lies within two Level III ecoregions (Southwestern Appalachians and Central Appalachians) and contains two Level IV subcoregions (68a and 69d), as shown in Figure 2 (USEPA, 1997):

- The Cumberland Plateau (68a) tablelands and open low mountains are about 1,000 feet higher than to the west, and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief compared to the Cumberland Mountains or the Plateau Escarpment (68c). Elevations are generally 1,200-2,000 feet, with the Crab Orchard Mountains reaching over 3,000 feet. Pennsylvania-age conglomerate, sandstone, siltstone, and shale is covered by mostly well-drained, acidic soils of low fertility. The region is forested, with some agriculture and coal mining activities.
- The Cumberland Mountains (69d), in contrast to the sandstone-dominated Cumberland Plateau (68a) to the west and southwest, are more highly dissected, with narrow-crested steep slopes, and younger Pennsylvanian-age shales, sandstones, siltstones, and coal. Narrow, winding valleys separate the mountain ridges, and relief is often 2,000 feet. Cross Mountain, west of Lake City, reaches 3,534 feet in elevation. Soils are generally well-drained, loamy, and acidic,

with low fertility. The natural vegetation is a mixed mesophytic forest, although composition and abundance vary greatly depending on aspect, slope position, and degree of shading from adjacent land masses. Large tracts of land are owned by lumber and coal companies, and there are many areas of stripmining.

The Tennessee portion of the Clear Fork River Watershed has approximately 441.6 miles of streams (based on USEPA/TDEC Assessment Database (ADB)) and drains approximately 333 sq. mi. to the Cumberland River. Watershed land use distribution is based on the 1992 Multi-Resolution Land Characteristic (MRLC) satellite imagery databases derived from Landsat Thematic Mapper digital images from 1990-1993. Land use for the Clear Fork River Watershed is summarized in Table 1 and shown in Figure 3.

Figure 1 Location of the Clear Fork River Watershed

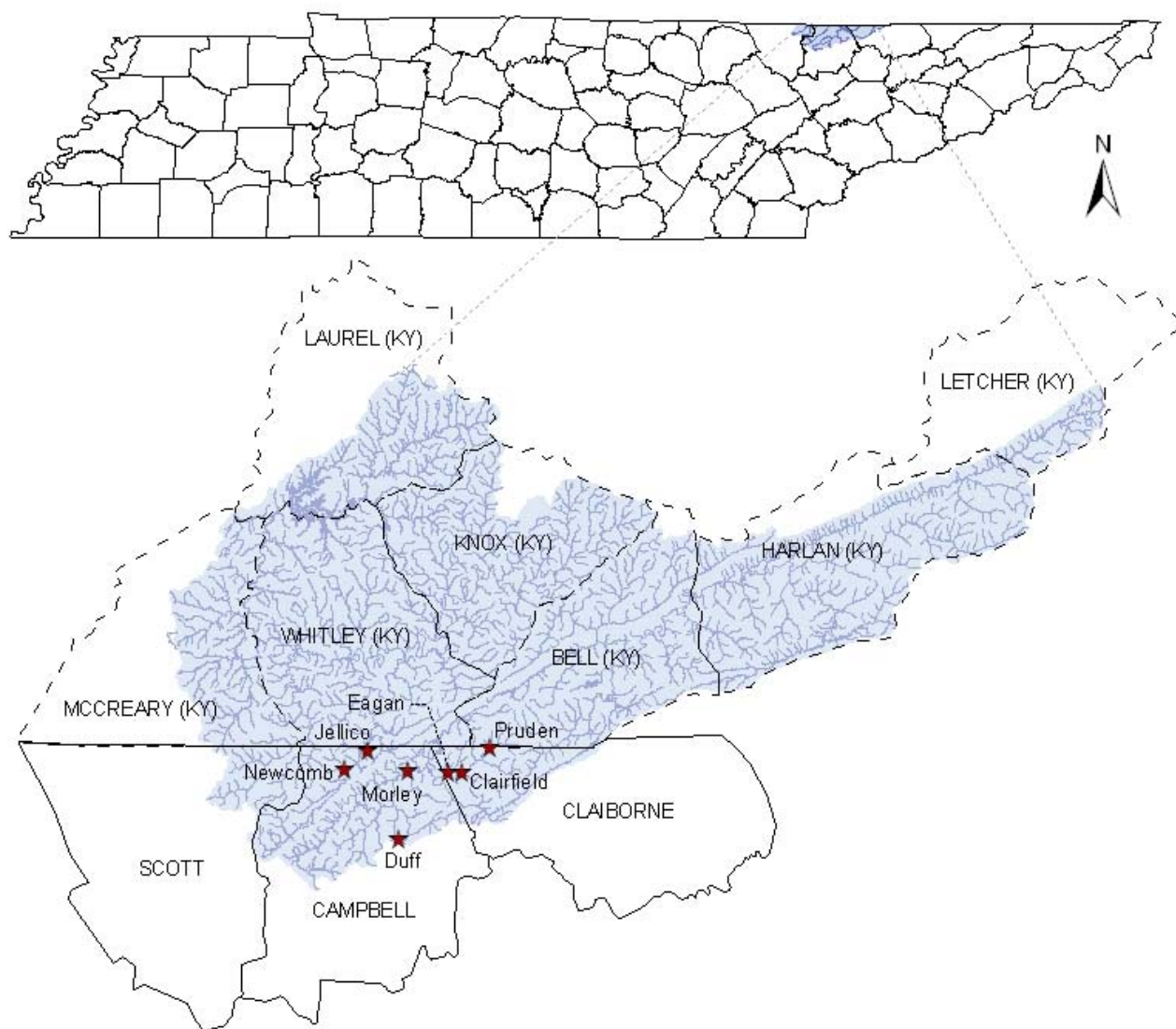


Figure 2 Level IV Ecoregions in the Clear Fork River Watershed

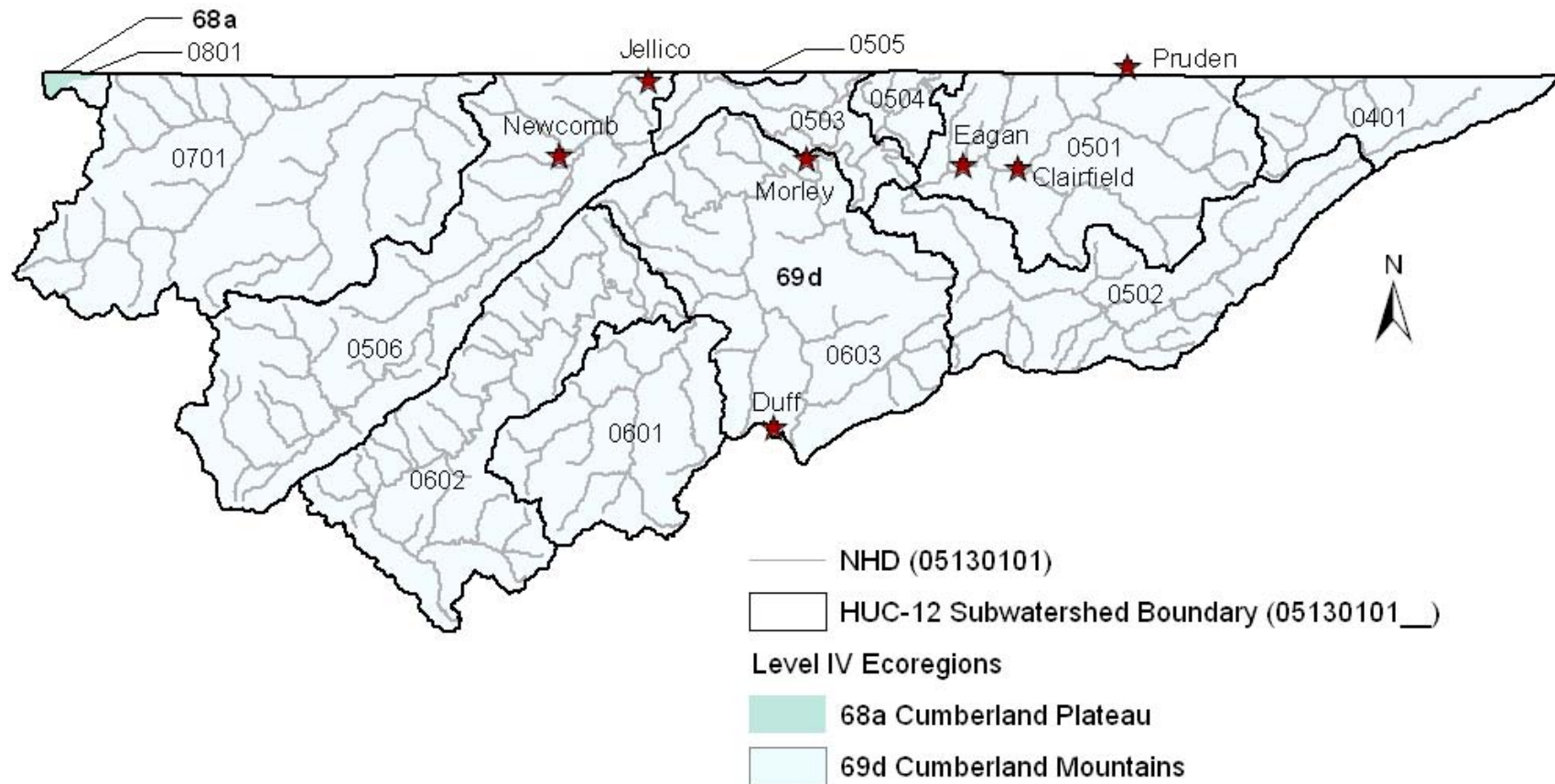


Table 1 Land Use Distribution - Clear Fork River Watershed

Land use	Area		
	[acres]	[mi ²]	[% of watershed]
Deciduous Forest	175,163	273.7	82.2
Emergent Herbaceous Wetlands	36	0.1	0.0
Evergreen Forest	8,163	12.8	3.8
High Intensity Commercial/Industrial/Transportation	580	0.9	0.3
High Intensity Residential	64	0.1	0.0
Low Intensity Residential	606	0.9	0.3
Mixed Forest	22,133	34.6	10.4
Open Water	228	0.4	0.1
Other Grasses (Urban/recreational)	228	0.4	0.1
Pasture/Hay	3,605	5.6	1.7
Quarries/Strip Mines/Gravel Pits	298	0.5	0.1
Row Crops	698	1.1	0.3
Transitional	1,021	1.6	0.5
Woody Wetlands	289	0.5	0.1
Total	213,113	333.0	100.0

Note: A spreadsheet was used for this calculation and values are approximate due to rounding.

3.0 PROBLEM DEFINITION

The State of Tennessee's *2006 303(d) List* (TDEC, 2006) identified a number of waterbodies in the Clear Fork River Watershed as not fully supporting designated use classifications due, in part, to siltation and/or habitat alteration associated with undetermined sources and abandoned mining. These waterbodies are summarized in Table 2 and shown in Figure 4. The designated use classifications for the Tennessee portion of the Clear Fork of the Cumberland River and its tributaries include Fish & Aquatic Life, Recreation, Livestock Watering & Wildlife, and Irrigation. Some streams are also classified for Trout Stream and/or Domestic Water Supply (TDEC, 2004).

A description of the stream assessment process in Tennessee can be found in *2006 305(b) Report, The Status of Water Quality in Tennessee* (TDEC, 2006a). This document states that "the most satisfactory method for identification of impairment due to silt has been biological surveys that include habitat assessments." With respect to biological integrity and the fish and aquatic life use classification, the document further states that "biological surveys using macroinvertebrates as the indicator organisms are the preferred method for assessing use support." The waterbody segments listed in Table 2 were assessed as impaired based primarily on biological surveys. The results of these assessment surveys are summarized in Table 3. The assessment information presented is excerpted from the ADB and is referenced to the waterbody IDs in Table 2. ADB information may be accessed at:

<http://gwidc.memphis.edu/website/dwpc/>

Figure 3 MRLC Land Use in the Clear Fork River Watershed

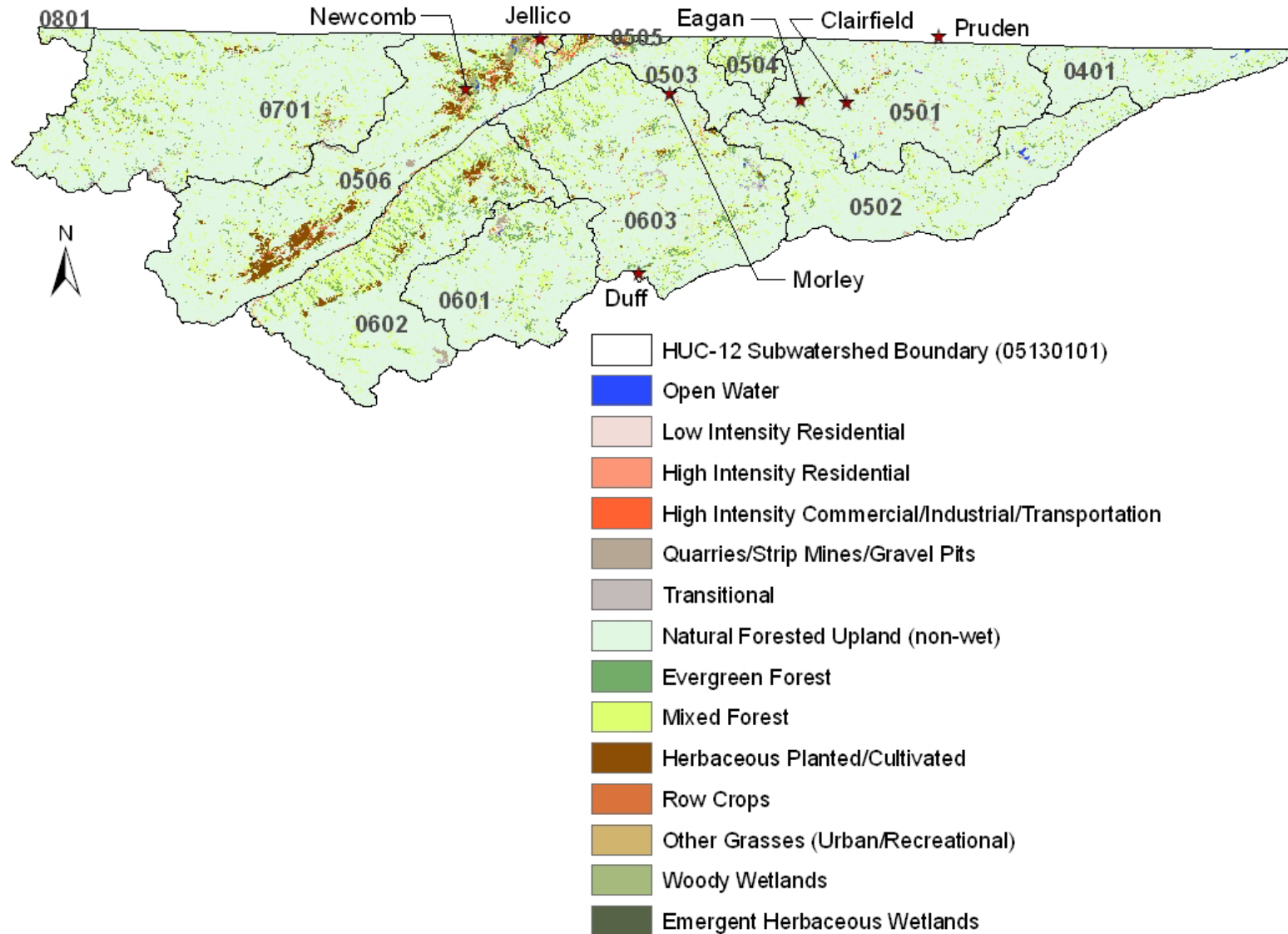


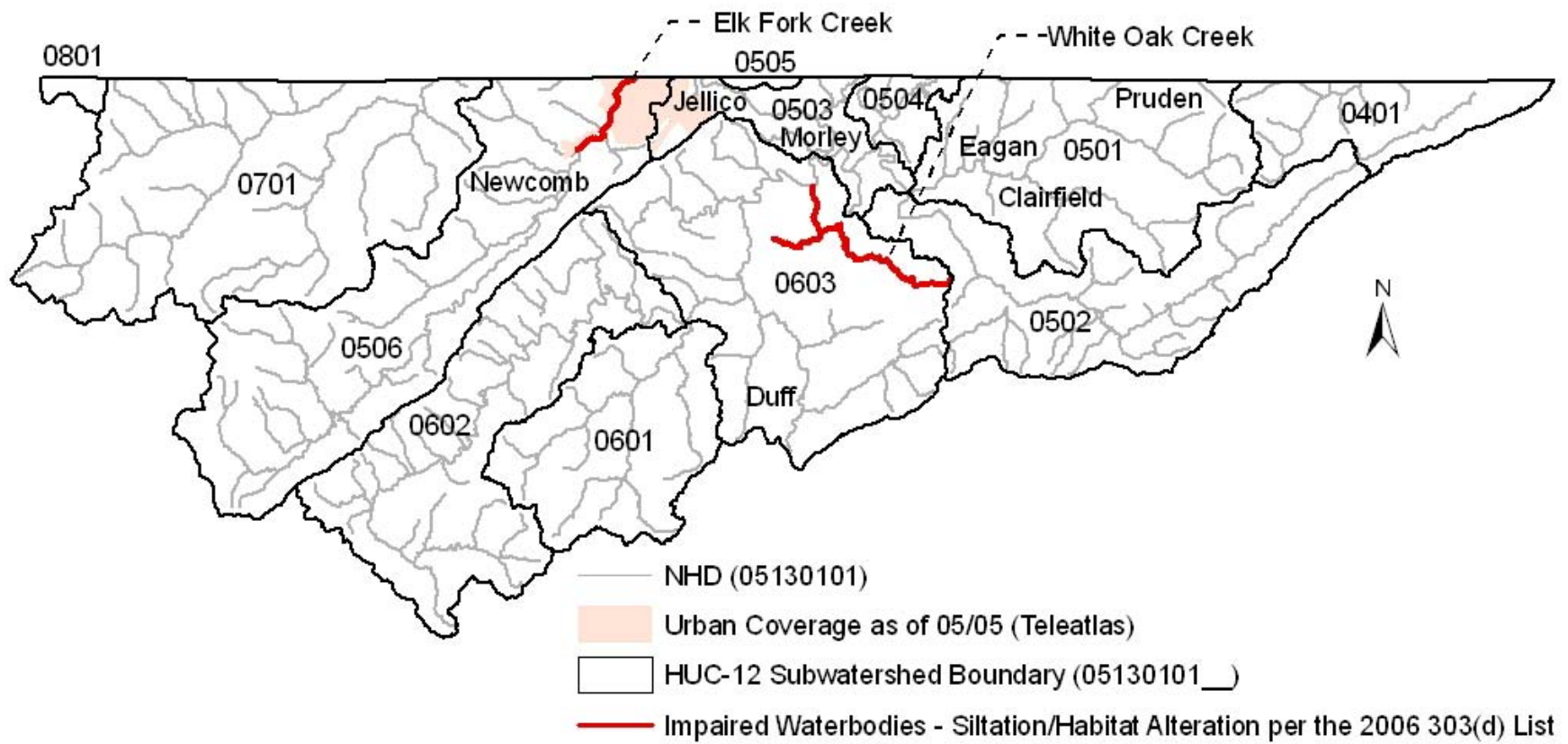
Table 2 2006 303(d) List - Stream Impairment Due to Siltation/Habitat Alteration in the Clear Fork River Watershed

HUC-12 Subwatershed (05130101__)	Waterbody ID	Impacted Waterbody	Miles/Acres Impaired	Cause	Pollutant Source
0506	05130101091_1000	Elk Fork Creek	3.9	Loss of biological integrity due to siltation Other Habitat Alterations Escherichia coli	Abandoned Mining Septic Tanks
0603	05130101016_0100	White Oak Creek	6.7	Loss of biological integrity due to siltation Escherichia coli	Undetermined Source Septic Tanks

Table 3 Water Quality Assessment of Waterbodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130101__)	Waterbody ID	Impacted Waterbody	Comments
0506	05130101091_1000	Elk Fork Creek (from Kentucky state line to confluence of Crooked Creek)	High quality stream in Indian Mountain State Park. 2004 TDEC chemical station at mile 0.2 (d/s Indian Mountain State Park). Four out of 12 E. coli observations over 487. Geo mean of six E. coli samples from July 1 - July 29, 2004 = 544. Septic tank failures. 2000 TDEC biorecon at mile 2.0 (d/s Indian Mtn St. Park Road). 8 EPT genera, 37 total genera. Habitat score = 125. NCBI = 5.81. E coli g.m. = 62.
0603	05130101016_0100	White Oak Creek (from Stinking Creek to headwaters)	2004 TDEC chemical station at mile 0.7 (private drive bridge). Three out of 13 E. coli observations over 487. Geo mean of six E. coli samples from July 1 - July 29, 2004 = 288. Septic tank failures. 2000 TDEC biorecon at mile 0.7 (off Little White Oak Road). 6 EPT genera, 29 total genera. Habitat score = 156. NCBI = 5.69. E coli g.m. = 70.

Figure 4 Waterbodies Impaired Due to Siltation/Habitat Alteration (Documented on the 2006 303(d) List)



An example of a typical stream assessment (White Oak Creek at RM 0.7) is shown in Appendix A.

Siltation is the process by which sediments are transported by moving water and deposited on the bottom of stream, river, and lakebeds. Sediment is created by the weathering of host rock and delivered to stream channels through various erosional processes, including sheetwash, gully and rill erosion, wind, landslides, dry gravel, and human excavation. In addition, sediments are often produced as a result of stream channel and bank erosion and channel disturbance. Movement of eroded sediments downslope from their points of origin into stream channels and through stream systems is influenced by multiple interacting factors (USEPA, 1999).

Siltation (sedimentation) is the most frequently cited cause of waterbody impairment in Tennessee, impacting over 5,800 miles of streams and rivers (TDEC, 2006a). Unlike many chemical pollutants, sediments are typically present in waterbodies in natural or background amounts and are essential to normal ecological function. Excessive sediment loading, however, is a major ecosystem stressor that can adversely impact biota, either directly or through changes to physical habitat.

Excessive sediment loading has a number of adverse effects on Fish & Aquatic Life in surface waters. As stated in excerpts from *Framework For Developing Suspended And Bedded Sediments (SABS) Water Quality Criteria* (USEPA, 2006):

Excessive suspended sediment in aquatic systems decrease light penetration, directly impacting productivity that is especially important in estuarine and marine habitats, where trophic interrelationships tend to be more complex and marginal when compared to freshwater aquatic systems. Decreased water clarity impairs visibility and associated behaviors such as prey capture and predator avoidance, recognition of reproductive cues, and other behaviors that alter reproduction and survival. At very high levels, suspended sediments can cause physical abrasion and clogging of filtration and respiratory organs.

In flowing waters, bedded sediments are likely to have a more significant impact on habitat and biota than suspended sediments; while most organisms can tolerate episodic occurrences of increased levels of suspended sediments, impacts can become chronic once the sediment is settled. When sediments are deposited or shift longitudinally along the streambed, infaunal or epibenthic organisms and demersal eggs are vulnerable to smothering and entrapment. In smaller amounts, excess fine sediments can fill in gaps between larger substrate particles, embedding the larger particles, and eliminating interstitial spaces that could otherwise be used as habitat for reproduction, feeding, and cover for invertebrates and fish. A noteworthy example of effects of bedded sediments in streams and rivers is the loss of spawning habitat for salmonid fishes due to increased embeddedness. Increased sedimentation can limit the amount of oxygen in the spawning beds, which can reduce hatching success, trap the fry in the sediment after hatching, or reduce the area of habitat suitable for development.

Historically, waterbodies in Tennessee have been assessed as not fully supporting designated uses due to siltation when the impairment was determined to be the result of excess loading of the inorganic sediment produced by erosional processes. In cases where impairment was determined to be caused by excess loading of the primarily organic particulate material found in sewage

treatment plant (STP) effluent, the cause of pollution was listed as total suspended solids (TSS) or organic enrichment. In consideration of this practice, this document presents the details of TMDL development for waterbodies in the Clear Fork River Watershed listed as impaired due to siltation (excess inorganic sediment produced by erosional processes) and/or appropriate cases of habitat alteration. The TSS in STP effluent is considered to be a distinctly different pollutant and, therefore, is excluded in sediment loading calculations.

4.0 TARGET IDENTIFICATION

Several narrative criteria, applicable to siltation/habitat alteration, are established in *Rules of Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Division of Water Pollution Control, Chapter 1200-4-3 General Water Quality Criteria, January, 2004* (TDEC, 2004a):

Applicable to all use classifications (Fish & Aquatic Life shown):

Solids, Floating Materials, and Deposits - There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish and aquatic life.

Other Pollutants - The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

Turbidity or Color - There shall be no turbidity or color in such amounts or of such character that will materially affect fish and aquatic life.

Applicable to the Fish & Aquatic Life use classification:

Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.

Interpretation of this provision for any stream which (a) has at least 80% of the upstream catchment area contained within a single bioregion and (b) is of the appropriate stream order specified for the bioregion, and (c) contains the habitat (riffle or rooted bank) specified for the bioregion, may be made using the most current revision of the Department's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys and/or other scientifically defensible methods.

Interpretation of this provision for all other streams, plus large rivers, reservoirs, and wetlands, may be made using Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (EPA/841-B-99-002) and/or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream

conditions or to appropriately selected reference sites in the same bioregion if upstream conditions are determined to be degraded.

Habitat - The quality of instream habitat shall provide for the development of a diverse aquatic community that meets regionally based biological integrity goals. The instream habitat within each subecoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.

These TMDLs are being established to attain full support of the Fish & Aquatic Life designated use classification. TMDLs established to protect fish and aquatic life will protect all other use classifications for the identified waterbodies from adverse alteration due to sediment loading.

In order for a TMDL to be established, a numeric “target” protective of the uses of the water must be identified to serve as the basis for the TMDL. Where State regulation provides a numeric water quality criteria for the pollutant, the criteria is the basis for the TMDL. Where State regulation does not provide a numeric water quality criteria, as in the case of siltation/habitat alteration, a numeric interpretation of the narrative water quality standard must be determined. For the purpose of these TMDLs, the average annual instream sediment loading in lbs/acre/yr, from a biologically healthy watershed, located within the same Level IV ecoregion as the impaired watershed, is determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish and aquatic life. Biologically healthy watersheds were identified from the State’s ecoregion reference sites. These ecoregion reference sites have similar characteristics and conditions as the majority of streams within that ecoregion. Detailed information regarding Tennessee ecoregion reference sites can be found in *Tennessee Ecoregion Project, 1994-1999* (TDEC, 2000). In general, land use in ecoregion reference watersheds consist of less pasture, cropland, and urban areas and more forested areas compared to the impaired watersheds. The biologically healthy (reference) watersheds are considered the “least impacted” in an ecoregion and, as such, sediment loading from these watersheds may serve as an appropriate target for the TMDL.

Using the methodology described in Appendix B, the Watershed Characterization System (WCS) Sediment Tool was used to calculate the average annual instream sediment load for each of the biologically healthy (reference) watersheds in Level IV Ecoregions 68a and 69d. The geometric mean of the average annual instream sediment loads of the reference watersheds in each Level IV ecoregion was selected as the most appropriate target for that ecoregion. Since the impairment of biological integrity due to sediment build-up is generally a long-term process, using an average annual load is considered appropriate. The average annual instream sediment loads for reference sites and corresponding TMDL target values for Level IV Ecoregions 68a and 69d are summarized in Table 4. Reference site locations are shown in Figure 5.

5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Using the methodology described in Appendix B, the WCS Sediment Tool was used to determine the average annual instream sediment load, due to precipitation-based sources, for all HUC-12 subwatersheds in the Clear Fork River Watershed (ref.: Figure 4). Existing instream sediment loads for subwatersheds with waterbodies listed on the *2006 303(d) List* as impaired for siltation/habitat alteration are summarized in Table 5.

Table 4 Average Annual Sediment Loads of Level IV Ecoregion Reference Sites

Level 4 Ecoregion	Reference Site	Stream	Drainage Area	Average Annual Sediment Load
			(acres)	[lbs/acre/year]
68a	Eco68a01	Rock Creek	3,718	49.0
	Eco68a03	Laurel Fork Of Station Camp Creek	10,828	79.4
	Eco68a08	Clear Creek	98,904	160.0
	Eco68a13	Piney Creek	8,947	175.4
	Eco68a20	Mullens Creek	7,388	123.3
	Eco68a26	Daddys Creek	110,890	465.2
	Eco68a28	Rock Creek	16,036	100.5
Geometric Mean (Target Load)				130.1
69d	Eco69d01	No Business Branch	1,615	53.9
	Eco69d03	Flat Fork	4,459	307.1
	Eco69d04	Stinking Creek	7,924	867.8
	Eco69d05	New River	2,125	166.5
	Eco69d06	Round Rock Creek	8,936	671.5
Geometric Mean (Target Load)				276.1

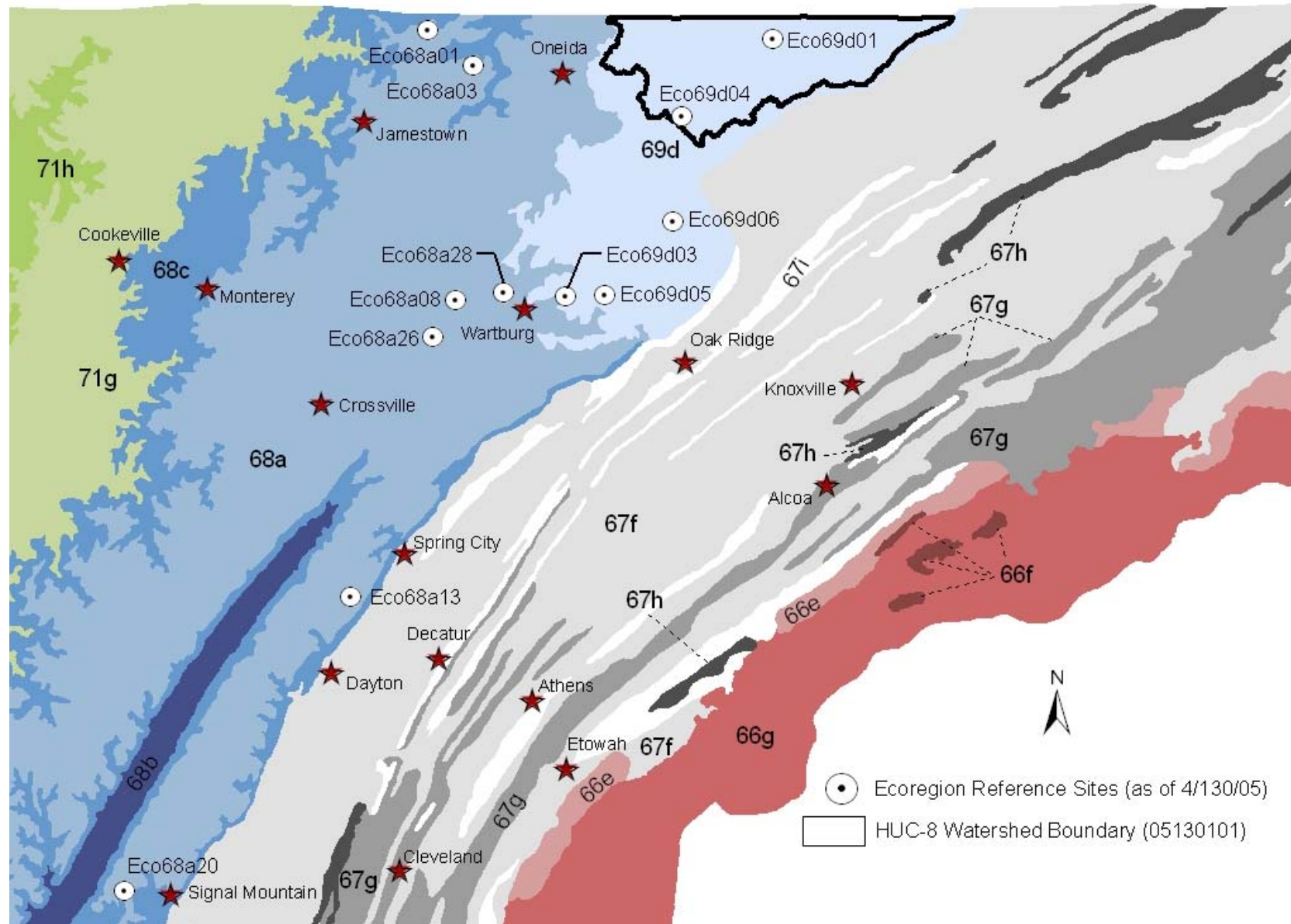
Table 5 Existing Sediment Loads in Subwatersheds with Impaired Waterbodies

HUC-12 Subwatershed (05130101____)	Existing Sediment Load
	[lbs/ac/yr]
0506	1,883.6
0603	417.0

6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of siltation in the watershed and the amount of pollutant loading contributed by each of these sources. Under the Clean Water Act, sources are broadly classified as either point or nonpoint sources. Under 40 CFR 122.2, a point source is defined as a discernable, confined and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Regulated point sources include: 1) municipal and industrial wastewater treatment facilities (WWTFs); 2) storm water discharges associated with industrial activity (which includes construction activities); and 3) certain discharges from Municipal Separate Storm Sewer Systems (MS4s). A TMDL must provide Waste Load Allocations (WLAs) for all NPDES regulated point sources. For the purposes of these TMDLs, all sources of sediment loading not regulated by NPDES are considered nonpoint sources. The TMDL must provide a Load Allocation (LA) for these sources.

Figure 5 Reference Sites in Level IV Ecoregions 68a and 69d



6.1 Point Sources

6.1.1 NPDES Regulated Wastewater Treatment Facilities

As stated in Section 3.0, the TSS component of STP discharges is generally composed of primarily organic material and is considered to be different in nature than the sediments produced from erosional processes. Therefore, TSS discharges from STPs are not included in the TMDLs developed for this document.

6.1.2 NPDES Regulated Ready Mixed Concrete Facilities

Discharges from regulated Ready Mixed Concrete Facilities (RMCFs) may contribute sediment to surface waters as TSS discharges (TSS discharged from RMCFs is composed of primarily inorganic material and is therefore included as a source for TMDL development). Most of these facilities obtain coverage under NPDES Permit No. TNG110000, *General NPDES Permit for Discharges of Storm Water Runoff and Process Wastewater Associated With Ready Mixed Concrete Facilities* (TDEC, 2007). This permit establishes a daily maximum TSS concentration limit of 50 mg/l on process wastewater effluent and specifies monitoring procedures for storm water discharges. Facilities are also required to develop and implement storm water pollution prevention plans (SWPPPs). Discharges from RMCFs are generally intermittent, and contribute a small portion of total sediment loading to HUC-12 subwatersheds. In some cases, for discharges into impaired waters, sites may be required to obtain coverage under an individual NPDES permit. There were no permitted RMCFs in the Clear Fork River Watershed as of October 10, 2007.

6.1.3 NPDES Regulated Mining Sites

Discharges from regulated mining activities may contribute sediment to surface waters as TSS (TSS discharged from mining sites is composed of primarily inorganic material and is therefore included as a source for TMDL development). Discharges from active mines may result from dewatering operations and/or in response to storm events, whereas discharges from permitted inactive mines are only in response to storm events. Inactive sites with successful surface reclamation contribute relatively little solids loading. Of the thirty-eight permitted mining sites in the Clear Fork River Watershed as of October 10, 2007, eight are located in impaired subwatersheds. These facilities are listed in Table 6 and shown in Figure 6. Sediment loads (as TSS) to waterbodies from mining site discharges are very small in relation to total sediment loading (ref.: Appendix E).

6.1.4 NPDES Regulated Construction Activities

Discharges from NPDES regulated construction activities are considered point sources of sediment loading to surface waters and occur in response to storm events. Currently, discharges of storm water from construction activities disturbing an area of one acre or more must be authorized by an NPDES permit. Most of these construction sites obtain coverage under NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005). Since construction activities at a site are of a temporary, relatively short-term nature, the number of construction sites covered by the general permit at any instant of time varies. Of the four permitted active construction storm water sites in the Clear Fork River Watershed on October 10, 2007, one was in an impaired subwatershed (ref.: Figure 7).

Table 6 NPDES Regulated Mining Sites Permitted to Discharge TSS and Located in Impaired Subwatersheds (as of October 10, 2007)

HUC-12 Subwatershed (05130101___)	NPDES Permit No.	Name	TSS Daily Max Limit
			[mg/l]
0506	TN0042722	Mountainside Coal Co.	40
	TN0052493	W. H. Bowlin Coal Company (Tippie #1)	
	TN0066095	Elkview Land & Gravel Co.	
	TN0071714	Dewayne Rowe Logging & Coal (O'dell-Irish Co. Area #1)	
0603	TN0063576	Gatliff Coal Co. (White Oak Area #4)	
	TN0068918	Gatliff Coal Co. (White Oak Area #11)	
	TN0070963	Gatliff Coal Co. (White Oak Area #15)	
	TN0071145	Gatliff Coal Co. (White Oak Area #12)	

6.1.5 NPDES Regulated Municipal Separate Storm Sewer Systems (MS4s)

MS4s may discharge sediment to waterbodies in response to storm events through road drainage systems, curb and gutter systems, ditches, and storm drains. These systems convey urban runoff from surfaces such as bare soil and wash-off of accumulated street dust and litter from impervious surfaces during rain events. Phase I of the EPA storm water program requires large and medium MS4s to obtain NPDES storm water permits. Large and medium MS4s are those located in incorporated places or counties serving populations greater than 100,000 people. At present, there are no Phase I large or medium MS4s in the Clear Fork River Watershed.

As of March 2003, regulated small MS4s in Tennessee must also obtain NPDES permits in accordance with the Phase II storm water program. A small MS4 is designated as *regulated* if: a) it is located within the boundaries of a defined urbanized area that has a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile; b) it is located outside of an urbanized area but within a jurisdiction with a population of at least 10,000 people, a population density of 1,000 people per square mile, and has the potential to cause an adverse impact on water quality; or c) it is located outside of an urbanized area but contributes substantially to the pollutant loadings of a physically interconnected MS4 regulated by the NPDES storm water program. Most regulated small MS4s in Tennessee obtain coverage under the *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2003). At present, there are no permitted Phase II small MS4s in the Clear Fork River Watershed.

The Tennessee Department of Transportation (TDOT) has been issued an individual MS4 permit (TNS077585) that authorizes discharges of storm water runoff from State road and interstate highway rights-of-way that TDOT owns or maintains, discharges of storm water runoff from TDOT owned or operated facilities, and certain specified non-storm water discharges. This permit covers all eligible TDOT discharges statewide, including those located outside of urbanized areas.

Information regarding storm water permitting in Tennessee may be obtained from the TDEC website at <http://www.state.tn.us/environment/wpc/stormh2o/>.

Figure 6 NPDES Regulated Mining Sites Located in Impaired Subwatersheds

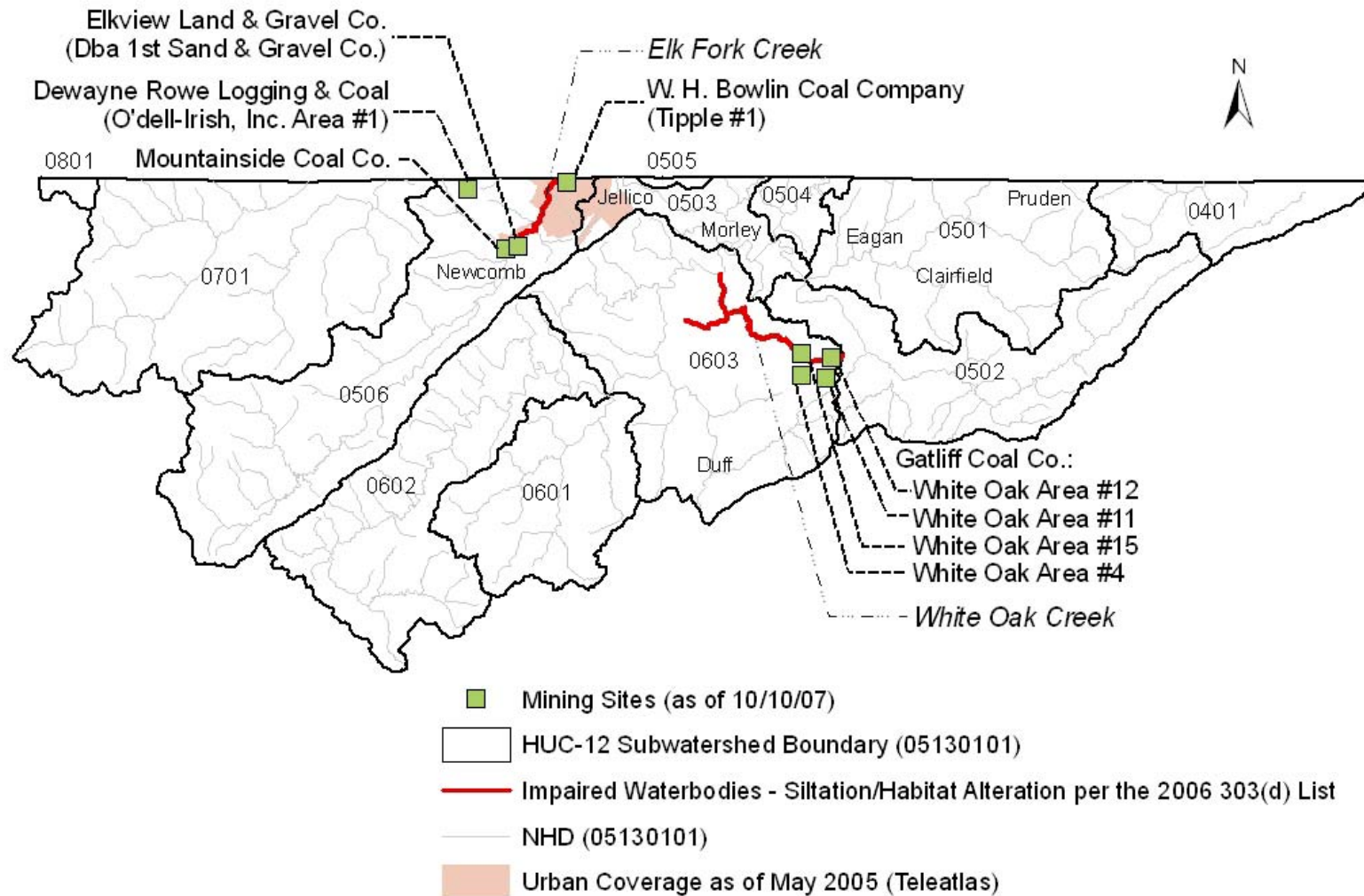
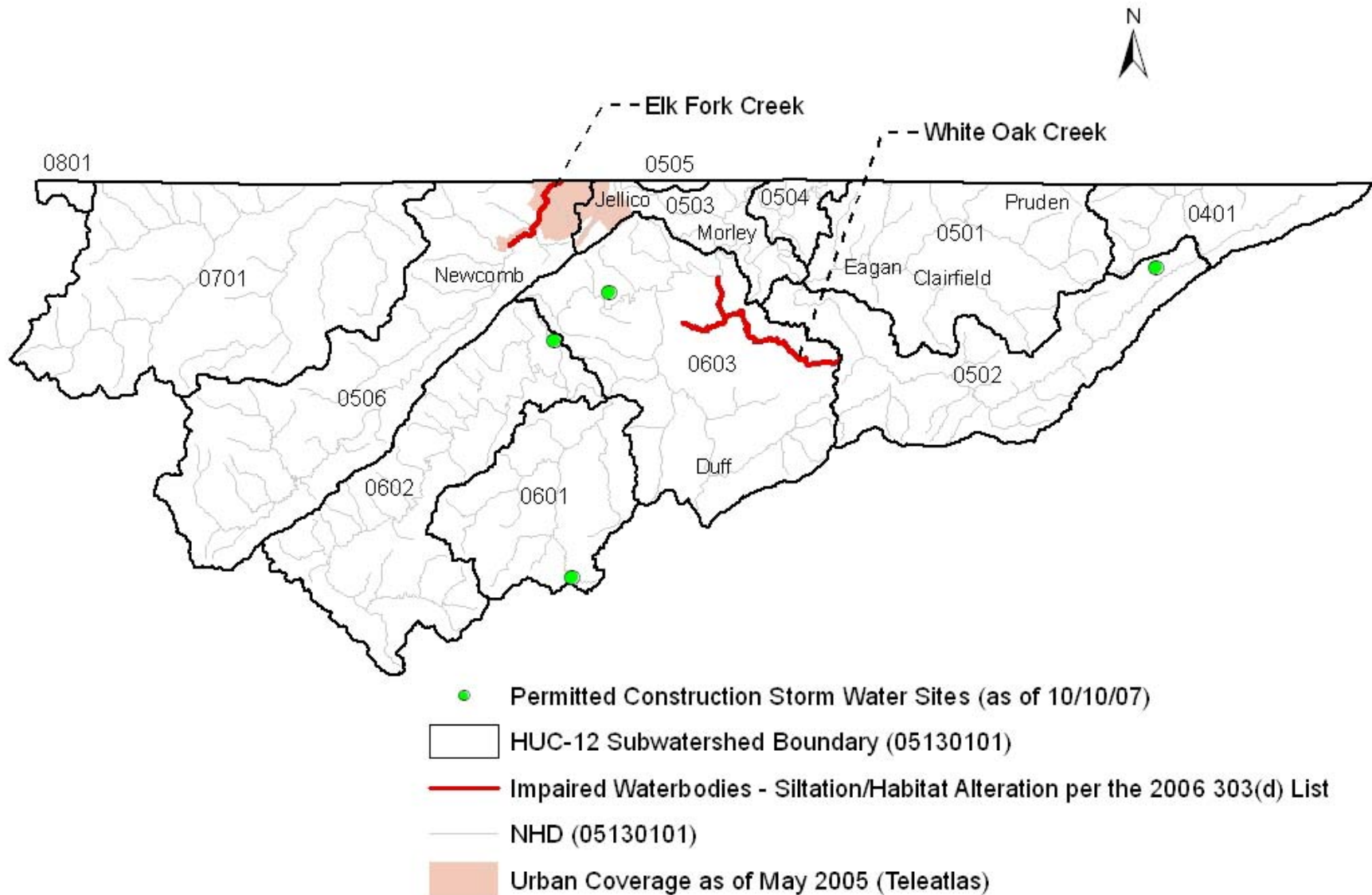


Figure 7 Location of NPDES Permitted Construction Storm Water Sites in the Clear Fork River Watershed



6.2 Nonpoint Sources

Nonpoint sources account for the vast majority of sediment loading to surface waters. These sources include:

- Natural erosion occurring from the weathering of soils, rocks, and uncultivated land; geological abrasion; and other natural phenomena.
- Erosion from agricultural activities can be a major source of sedimentation due to the large land area involved and the land-disturbing effects of cultivation. Grazing livestock can leave areas of ground with little vegetative cover. Unconfined animals with direct access to streams can cause streambank damage.
- Urban erosion from bare soil areas under construction and washoff of accumulated street dust and litter from impervious surfaces.
- Erosion from unpaved roadways can be a significant source of sediment to rivers and streams. It occurs when soil particles are loosened and carried away from the roadway, ditch, or road bank by water, wind, or traffic. The actual road construction (including erosive road-fill soil types, shape and size of coarse surface aggregate, poor subsurface and/or surface drainage, poor road bed construction, roadway shape, and inadequate runoff discharge outlets or “turn-outs” from the roadway) may aggravate roadway erosion. In addition, external factors such as roadway shading and light exposure, traffic patterns, and road maintenance may also affect roadway erosion. Exposed soils, high runoff velocities and volumes and poor road compaction all increase the potential for erosion.
- Runoff from abandoned mines may be significant sources of solids loading. Mining activities typically involve removal of vegetation, displacement of soils, and other significant land disturbing activities.
- Soil erosion from forested land that occurs during timber harvesting and reforestation activities. Timber harvesting includes the layout of access roads, log decks, and skid trails; the construction and stabilization of these areas; and the cutting of trees. Established forest areas produce very little soil erosion.

For impaired waterbodies within the Clear Fork River Watershed, the primary sources of nonpoint sediment loads come from agriculture, roadways, and urban sources. The watershed land use distribution based on the 1992 MRLC satellite imagery databases is shown in Appendix C for impaired HUC-12 subwatersheds.

7.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma \text{WLAs} + \Sigma \text{LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. It should be noted, however, that as a result of a recent court decision, EPA has recommended that all TMDLs, WLAs, and LAs include “a daily time increment in conjunction with other temporal expressions that may be necessary to implement relevant water quality standards” (USEPA, 2007). The TMDLs and allocations developed in this document are in accordance with this guidance.

7.1 Sediment Loading Analysis Methodology

TMDL analyses were performed on a 12-digit hydrologic unit code (HUC-12) area basis for subwatersheds containing waterbodies identified as impaired due to siltation and/or habitat alteration on the *2006 303(d) List*. HUC-12 subwatershed boundaries are shown in Figure 4.

Sediment loading analysis for impaired subwatersheds in the Clear Fork River Watershed was conducted using the Watershed Characterization System (WCS) Sediment Tool. WCS is an ArcView geographic information system (GIS) based program developed by USEPA Region IV to facilitate watershed characterization and TMDL development. The Sediment Tool is an extension of WCS that utilizes available GIS coverages (land use, soils, elevations, roads, etc), the Universal Soil Loss Equation (USLE) to calculate potential erosion, and sediment delivery equations to calculate sediment delivery to the stream network (see Appendix B).

Using the Sediment Tool, the existing average annual instream sediment load of each impaired HUC-12 subwatershed was determined. This value was compared to the appropriate ecoregion-based target load specified in Section 4 and the overall required percent reduction in instream sediment loading calculated. A portion of the target load was reserved to account for discharges from NPDES permitted RMCs, mining sites, and construction sites, with the remainder allocated to MS4s and nonpoint source loading. Daily expressions of allowable loads were developed for precipitation-based sources by dividing the calculated average annual target load by the average annual precipitation.

The loading analysis methodology is described in detail in Appendix D.

7.2 TMDLs for Impaired Subwatersheds

For each impaired subwatershed, the TMDL consists of: a) the required overall percent reduction in instream sediment loading and b) the allowable daily instream sediment load per unit area per inch of precipitation (lbs/ac/in. precipitation). TMDLs for impaired subwatersheds are summarized in Table 7.

7.3 Waste Load Allocations

7.3.1 Waste Load Allocations for NPDES Regulated Ready Mixed Concrete Facilities

As of October 10, 2007, there were no permitted RMCFs in the Clear Fork River Watershed so no WLAs were developed specifically for RMCFs.

Table 7 Sediment TMDLs for Subwatersheds with Waterbodies Impaired for Siltation/Habitat Alteration

HUC-12 Subwatershed (05130101____)	Waterbody ID	Waterbody Impaired by Siltation/Habitat Alteration	TMDL *	
			Required Overall Load Reduction	Daily Maximum Load
			[% Reduction]	[lbs/ac/in. precip.]
0506	05130101091_1000	Elk Fork Creek	85.3	5.4
0603	05130101016_0100	White Oak Creek	33.8	5.3

* Applicable to instream sediment at pour point of HUC-12 subwatershed

7.3.2 Waste Load Allocations for NPDES Regulated Mining Sites

Of the thirty-eight permitted mining sites in the Clear Fork River Watershed with NPDES permits, eight are located in impaired subwatersheds (ref.: Table 6 and Figure 6). Since sediment loading from mining sites located in impaired subwatersheds is small (ref.: Appendix E) compared to the total loading for impaired subwatersheds, further reductions were not considered warranted.

7.3.3 Waste Load Allocations for NPDES Regulated Construction Activities

Point source discharges of storm water from construction activities (including clearing, grading, filling, excavating, or similar activities) that result in the disturbance of one acre or more of total land area must be authorized by an NPDES permit (ref.: Section 6.1.4). Since these discharges have the potential to transport sediment to surface waters, WLAs are provided for this category of activities. WLAs for construction site discharges were derived from EPA estimates of the reductions in sediment runoff that can be achieved through the proper design, installation, and maintenance of erosion and sediment BMPs. WLAs are equal to a) an average annual erosion load from the construction site of 6,000 lbs/ac/yr and b) the allowable daily erosion load per unit area per inch of precipitation (lbs/ac/in. precipitation).

Note: WLAs for construction storm water discharges are technology based and are specified as allowable erosion loads from construction sites. TMDLs, other WLAs, and LAs are discussed in terms of instream sediment loading. The relationship between erosion and sediment delivered to surface waters is discussed in Appendices B, D and F.

7.3.4 Waste Load Allocations for NPDES Regulated Municipal Separate Storm Sewer Systems (MS4s)

Municipal separate storm sewer systems (MS4s) are regulated by the State's NPDES program (ref.: Section 6.1.5). Since MS4s have the potential to discharge TSS to surface waters, WLAs are specified for these systems. WLAs are established for each HUC-12 subwatershed containing a waterbody identified on the 2006 303(d) List as impaired due to siltation and/or habitat alteration (ref.: Table 2). WLAs for most impaired subwatersheds are expressed as: a) the required percent reduction in the estimated average annual instream sediment loading for an impaired subwatershed, relative to the estimated average annual instream sediment loading of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (minus the percent reserved for RMCs, regulated mining sites, and CSW sites) and b) the allowable daily instream sediment load per unit area per inch of precipitation (lbs/ac/in. precipitation). Instream sediment loads are evaluated at the pour point of the HUC-12 subwatershed.

WLAs for MS4s are tabulated in Table 8 and apply to MS4 discharges in the impaired subwatershed for which the WLA was developed and will be implemented as Best Management Practices (BMPs) as specified in Phase I and II MS4 permits. WLAs should not be construed as numeric limits.

Table 8 Summary of WLAs for Construction Storm Water Sites and MS4s and LAs for Nonpoint Sources

HUC-12 Subwatershed (05130101___)	WLAs				LAs ^b	
	Construction Storm Water ^a		MS4s ^b		Required Load Reduction	Daily Maximum Load
	Annual Average Load	Daily Maximum Load	Required Load Reduction	Daily Maximum Load		
	[lbs/ac/yr]	[lbs/ac/ in. precip.]	[%]	[lbs/ac/in. precip.]	[%]	[lbs/ac/ in. precip.]
0506	6,000	116.3	88.2	4.3	88.2	4.3
0603	6,000	115.6	46.3	4.3	46.3	4.3

a. Value shown is allowable erosion from construction sites.

b. Applicable as instream sediment at pour point of HUC-12 subwatershed.

7.4 Load Allocations for Nonpoint Sources

All sources of sediment loading to surface waters not covered by the NPDES program are provided a Load Allocation (LA). LAs are established for each HUC-12 subwatershed containing a waterbody identified on the *2006 303(d) List* as impaired due to siltation and/or habitat alteration (ref.: Table 2). For impaired subwatersheds, LAs are expressed as: a) the required percent reduction in the estimated average annual instream sediment loading for an impaired subwatershed, relative to the estimated average annual instream sediment loading of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (minus the percent reserved for RMCs, regulated mining sites, and CSW sites) and b) allowable daily instream sediment load per unit area per inch of precipitation (lbs/ac/in. precipitation). Instream sediment loads are evaluated at the pour point of the HUC-12 subwatershed. LAs are tabulated in Table 8.

7.5 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In these TMDLs, an implicit MOS was incorporated through the use of conservative modeling assumptions. These include:

- Target values based on Level IV ecoregion reference sites. These sites represent the least impacted streams in the ecoregion.
- The use of the sediment delivery process that results in the most sediment transport to surface waters (Method 2 in Appendix B).

In most presently impaired subwatersheds, some amount of explicit MOS is realized due to the WLAs specified for RMCs and NPDES permitted mining sites being less than the 5% of the target load reserved for these facilities.

7.6 Seasonal Variation

Sediment loading is expected to fluctuate according to the amount and distribution of rainfall. The determination of sediment loads on an average annual basis accounts for these differences through the rainfall erosivity index in the USLE (ref.: Appendix B). This is a statistic calculated from the annual summation of rainfall energy in every storm and its maximum 30-minute intensity.

8.0 IMPLEMENTATION PLAN

8.1 Point Sources

8.1.1 NPDES Regulated Ready Mixed Concrete Facilities

As of October 10, 2007, there were no permitted RMCs in the Clear Fork River Watershed. For any future facilities, WLAs will be implemented through compliance with NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005).

8.1.2 NPDES Regulated Mining Sites

WLAs for mining sites located in impaired subwatersheds will be implemented through the existing permit requirements for these sites.

8.1.3 NPDES Regulated Construction Storm Water

The WLAs provided to existing and future NPDES regulated construction activities will be implemented through appropriate erosion prevention and sediment controls and Best Management Practices (BMPs) as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005). This permit requires the development and implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP) prior to the commencement of construction activities. The SWPPP must be prepared in accordance with good engineering practices and the latest edition of the *Tennessee Erosion and Sediment Control Handbook* (TDEC, 2002) and must identify potential sources of pollution at a construction site that would affect the quality of storm water discharges and describe practices to be used to reduce pollutants in those discharges. In addition, the permit specifies a number of special requirements for discharges entering high quality waters or waters identified as impaired due to siltation. The permit does not authorize discharges that would result in a violation of a State water quality standard.

Unless otherwise stated, full compliance with the requirements of the *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* is considered to be consistent with the WLAs specified in Section 7.3.3 of this TMDL document.

8.1.4 NPDES Regulated Municipal Separate Storm Sewer Systems (MS4s)

For existing and future regulated discharges from municipal separate storm sewer systems (MS4s), WLAs will be implemented through Phase I and II MS4 permits. These permits will require the development and implementation of a Storm Water Management Plan (SWMP) that will reduce the discharge of pollutants to the "maximum extent practicable" and not cause or contribute to violations of State water quality standards. Both the *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2003) and the TDOT individual MS4 permit (TNS077585) require SWMPs to include the following six minimum control measures:

- 1) Public education and outreach on storm water impacts;
- 2) Public involvement/participation;

- 3) Illicit discharge detection and elimination;
- 4) Construction site storm water runoff control;
- 5) Post-construction storm water management in new development and re-development;
- 6) Pollution prevention/good housekeeping for municipal (or TDOT) operations.

The permits also contain requirements regarding control of discharges of pollutants of concern into impaired waterbodies, implementation of provisions of approved TMDLs, and description of methods to evaluate whether storm water controls are adequate to meet the requirements of approved TMDLs. In order to evaluate SWMP effectiveness and demonstrate compliance with specified WLAs, MS4s must develop and implement appropriate monitoring programs. An effective monitoring program could include:

- Effluent monitoring at selected outfalls that are representative of particular land uses or geographical areas that contribute to pollutant loading before and after implementation of pollutant control measures.
- Analytical monitoring of pollutants of concern in receiving waterbodies, both upstream and downstream of MS4 discharges, over an extended period of time.
- Instream biological monitoring at appropriate locations to demonstrate recovery of biological communities after implementation of storm water control measures.

The appropriate Environmental Field Office (EFO) (ref.: <http://tennessee.gov/environment/eac/>) should be consulted for assistance in the determination of monitoring strategies, locations, frequency, and methods within 12 months after the approval date of this TMDL. Details of the monitoring plan and monitoring data should be included in the annual report required by the MS4 permit.

8.2 Nonpoint Sources

The Tennessee Department of Environment & Conservation (TDEC) has no direct regulatory authority over most nonpoint source discharges. Reductions of sediment loading from nonpoint sources (NPS) will be achieved using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired waters. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. There are links to a number of publications and information resources on USEPA's Nonpoint Source Pollution website (ref.: <http://www.epa.gov/owow/nps/pubs.html>) relating to the implementation and evaluation of nonpoint source pollution control measures.

TMDL implementation activities will be accomplished within the framework of Tennessee's Watershed Approach (ref.: <http://www.state.tn.us/environment/wpc/watershed/>). The Watershed Approach is based on a five-year cycle and encompasses planning, monitoring, assessment, TMDLs, WLAs/LAs, and permit issuance. It relies on participation at the federal, state, local, and nongovernmental levels to be successful.

The actions of local government agencies and watershed stakeholders should be directed to accomplish the goal of a reduction of sediment loading in the watershed. There are a number of measures that are particularly well-suited to action by local stakeholder groups. These measures include, but are not limited to:

- Detailed surveys of impaired subwatersheds to identify additional sources of sediment loading.
- Advocacy of local area ordinances and zoning that will minimize sediment loading to waterbodies, including establishment of buffer strips along streambanks, reduction of activities within riparian areas, and minimization of road and bridge construction impacts.
- Educating the public as to the detrimental effects of sediment loading to waterbodies and measures to minimize this loading.
- Advocacy of agricultural BMPs (e.g., riparian buffer, animal waste management systems, waste utilization, stream stabilization, fencing, heavy use area treatment protection, livestock exclusion, etc.) and practices to minimize erosion and sediment transport to streams. The Tennessee Department of Agriculture (TDA) keeps a database of BMPs implemented in Tennessee. Of the 16 BMPs in the Clear Fork River Watershed as of March 21, 2007, four are in sediment-impaired subwatersheds (ref.: Figure 8).

Excellent examples of stakeholder involvement for the implementation of nonpoint source load allocations (LAs) specified in an approved TMDL are the watershed groups, The Cumberland River Compact, The Nature Conservancy (TNC), and The Cumberland Mountain RC&D Council.

The Cumberland River Compact is a unique non-profit group that believes a healthy environment can be had with a strong economy. Their membership reflects this belief. The Compact is made up of businesses, individuals, community organizations and agencies working in the Cumberland River watershed. Their mission is to enhance the water quality of the Cumberland River and its tributaries through education and by promoting cooperation among citizens, businesses, and agencies in Kentucky and Tennessee. More information can be obtained on <http://www.CumberlandRiverCompact.org/about.htm> or by contacting GERALYN HOEY, Executive Director, at geralynh@cumberlandrivercompact.org, at info@cumberlandrivercompact.org, or at 615-837-1151, or by contacting ART NEWBY, Committee Chairman, at art.newby@cte.aecom.com or at 615-642-1406.

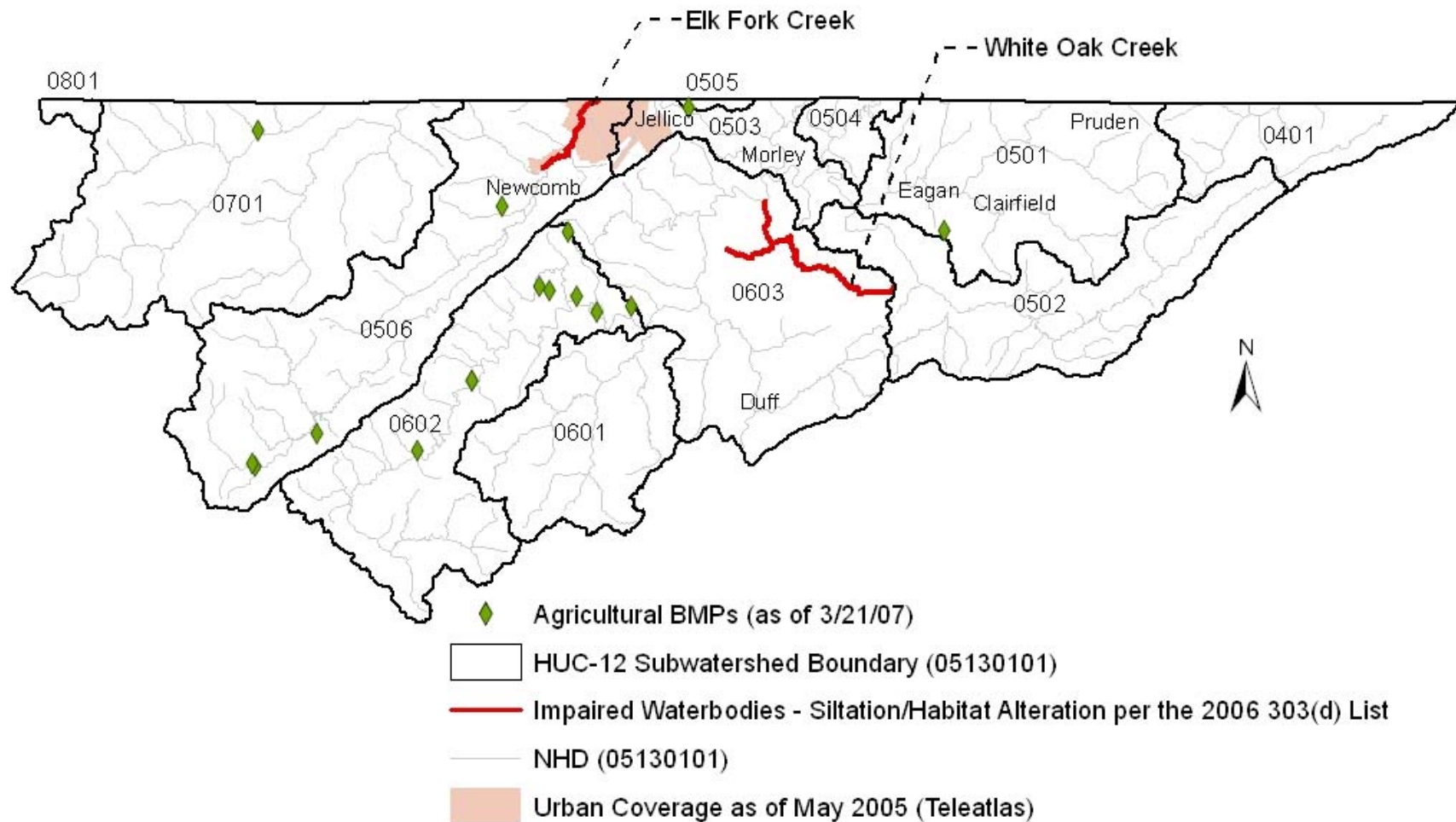
The Tennessee State Wildlife Action Plan (SWAP), formerly known as the Comprehensive Wildlife Conservation Strategy (CWCS), was developed by the Tennessee Wildlife Resources Agency with assistance from The Nature Conservancy in 2005. Congress mandated that each state and territory in the United States develop a SWAP as a requirement for continued receipt of federal State Wildlife Grant funding. These plans require the completion of 8 key elements of wildlife planning. In Tennessee, the SWAP was integrated into a spatial model using Geographic Information Systems (GIS) and other database technology. Priority aquatic, terrestrial, and subterranean areas for conservation were identified across the state. Priorities were determined in the GIS model based upon relative differences in species rarity, population viability, and potential mobility of species across habitat units. For complete information about the Tennessee SWAP, go to the website <http://www.state.tn.us/twra/wildlife/cwcs/cwcsindex.html>. For more information, contact Chris Bullington, State Conservation Planning Manager, at (615) 383-9909 x 227.

The Cumberland Mountain RC&D Council is a United States Department of Agriculture (**USDA**) program administered by the Natural Resources Conservation Service. This program helps people on a local level, with the assistance of a Federal Coordinator, to work together with many local organizations, county and city governments and conservation districts to implement natural resource protection and community development. Once a specific area has been authorized by the Secretary of Agriculture, that area is eligible for assistance through its RC&D council. RC&D council projects involving water are designed to help improve surface and groundwater quality and quantity. Projects may include watershed management; construction or rehabilitation of irrigation, flood control and water drainage systems; construction or rehabilitation of aquaculture, wastewater treatment and purification systems; installation of buffer strips; and efficient use of aquifers. The Cumberland Mountain RC&D council area includes five Tennessee counties: Anderson, Campbell, Morgan, Roane and Scott. For more information please contact Alan Neal, coordinator, at alan.neal@tn.usda.gov.

8.3 Evaluation of TMDL Effectiveness

The effectiveness of the TMDL will be assessed within the context of the State's rotating watershed management approach. Watershed monitoring and assessment activities will provide information by which the effectiveness of sediment loading reduction measures can be evaluated. Monitoring data, ground-truthing, and source identification actions will enable implementation of particular types of BMPs to be directed to specific areas in the subwatersheds. These TMDLs will be reevaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

Figure 8 Location of Agricultural Best Management Practices in the Clear Fork River Watershed



9.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed sediment TMDLs for the Clear Fork River Watershed was placed on Public Notice for a 35-day period and comments solicited. Steps that were taken in this regard include:

- 1) Notice of the proposed TMDLs was posted on the Tennessee Department of Environment and Conservation website. The notice invited public and stakeholder comments and provided a link to a downloadable version of the TMDL document.
- 2) Notice of the availability of the proposed TMDLs (similar to the website announcement) was included in one of the NPDES permit Public Notice announcements, which was sent to approximately 200 interested persons or groups who have requested this information.
- 3) Letters were sent to following point source facilities in the Clear Fork River Watershed that are permitted to discharge treated total suspended solids (TSS) and are located in impaired subwatersheds advising them of the proposed sediment TMDLs and their availability on the TDEC website. The letter also stated that a written copy of the draft TMDL document would be provided on request. Letters were sent to the following facilities:

TN0042722	Mountainside Coal Co.
TN0052493	W. H. Bowlin Coal Company (Tipple #1)
TN0063576	Gatliff Coal Co. (White Oak Area #4)
TN0066095	Elkview Land & Gravel Co.
TN0068918	Gatliff Coal Co. (White Oak Area #11)
TN0070963	Gatliff Coal Co. (White Oak Area #15)
TN0071145	Gatliff Coal Co. (White Oak Area #12)
TN0071714	Dewayne Rowe Logging & Coal (O'dell-Irish Co. Area #1)

- 4) A letter was sent to identified water quality partners in the Clear Fork River Watershed advising them of the proposed sediment TMDLs and their availability on the TDEC website and invited comments. These partners included:

Natural Resources Conservation Service
U.S.G.S. Water Resources Programs
U.S. Corps of Engineers
Tennessee Department of Agriculture
Kentucky Division of Water
The Cumberland River Compact
The Nature Conservancy
The Cumberland Mountain RC&D Council

5) A draft copy of the proposed sediment TMDLs was sent to the following MS4:

TNS077585 Tennessee Department of Transportation (TDOT)

No written comments were received during the Public Notice period.

10.0 FURTHER INFORMATION

Further information concerning Tennessee's TMDL program can be found on the Internet at the Tennessee Department of Environment and Conservation website:

<http://www.state.tn.us/environment/wpc/tmdl/>

Technical questions regarding these TMDLs should be directed to the following members of the Division of Water Pollution Control staff:

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APPENDIX A

Example of a Typical Stream Assessment (White Oak Creek at RM 0.7)

Figure A-1 White Oak Creek at RM 0.7, Habitat Assessment, front – July 19, 2004

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME <u>White Oak Creek</u>	LOCATION <u>White Oak Rd</u>
STATION # <u>RIVERMILE 0.7</u>	STREAM CLASS
LAT <u>LONG</u>	RIVER BASIN <u>Clear Fork Creek, River</u>
STORET # <u>WDAK-00704</u>	AGENCY <u>USPC</u>
INVESTIGATORS <u>JLB / MJA</u>	
FORM COMPLETED BY <u>JLB</u>	DATE <u>7/19/04</u> <u>11:20</u> AM PM REASON FOR SURVEY <u>303cd</u>

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE <u>12</u>	20 19 18 17 16	15 14 13 <u>12</u> 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE <u>12</u>	20 19 18 17 16	15 14 13 <u>12</u> 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE <u>15</u>	20 19 18 17 16	<u>15</u> 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old or new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (90% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE <u>13</u>	20 19 18 17 16	15 14 <u>13</u> 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <15% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or little substrate is mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE <u>12</u>	20 19 18 17 16	15 14 13 <u>12</u> 11	10 9 8 7 6	5 4 3 2 1 0

Figure A-2 White Oak Creek at RM 0.7, Habitat Assessment, back - July 19, 2004

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE 14	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE 7	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
SCORE 9 (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE 6 (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.					
SCORE 9 (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE 5 (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.					
SCORE 9 (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE 4 (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					

Total Score 127

Figure A-3 Photo of White Oak Creek at RM 0.7 - July 19, 2004



APPENDIX B

Watershed Sediment Loading Model

WATERSHED SEDIMENT LOADING MODEL

Determination of target average annual sediment loading values for reference watersheds and the sediment loading analysis of waterbodies impaired for siltation/habitat alteration was accomplished utilizing the Watershed Characterization System (WCS) Sediment Tool (v.3). WCS is an ArcView geographic information system (GIS) based program developed by USEPA Region IV to facilitate watershed characterization and TMDL development. WCS consists of an initial set of spatial and tabular watershed data, stored in a database, and allows the incorporation of additional data when available. It provides a number of reporting tools and data management utilities to allow users to analyze and summarize data. Program extensions, such as the sediment tool, expand the functionality of WCS to include modeling and other more rigorous forms of data analysis (USEPA, 2001).

Sediment Analysis

The Sediment Tool is an extension of WCS that utilizes available GIS coverages (land use, soils, elevations, roads, etc), the Universal Soil Loss Equation (USLE) to calculate potential erosion, and sediment delivery equations to calculate sediment delivery to the stream network. The following tasks can be performed:

- Estimate extent and distribution of potential soil erosion in the watershed.
- Estimate potential sediment delivery to receiving waterbodies.
- Evaluate effects of land use, BMPs, and road network on erosion and sediment delivery.

The Sediment Tool can also be used to evaluate different scenarios, such as the effects of changing land uses and implementation of BMPs, by the adjustment of certain input parameters. Parameters that may be adjusted include:

- Conservation management and erosion control practices
- Changes in land use
- Implementation of Best Management Practices (BMPs)
- Addition/Deletion of roads

Sediment analyses can be performed for single or multiple watersheds.

Universal Soil Loss Equation

Erosion potential is based on the Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith. It has been the most widely accepted and utilized soil loss equation for over 30 years. The USLE is a method to predict the average annual soil loss on a field slope based on rainfall pattern, soil type, topography, crop system and management practices. The USLE only predicts the amount of soil loss resulting from sheet or rill erosion on a single slope and does not account for soil losses that might occur from gully, wind, or tillage erosion. Designed as a model for use with certain cropping and management systems, it is also applicable to non-agricultural situations (OMAFRA, 2000). While the USLE can be used to estimate long-term average annual soil loss, it cannot be applied to a specific year or a

specific storm. Based on its long history of use and wide acceptance by the forestry and agricultural communities, the USLE was considered to be an adequate tool for estimating the relative long-term average annual soil erosion of watersheds and evaluating the effects of land use changes and implementation of BMP measures.

Soil loss from sheet and rill erosion is primarily due to detachment of soil particles during rain events. It is the cause of the majority of soil loss for lands associated with crop production, grazing areas, construction sites, mine sites, logging areas and unpaved roads. In the USLE, five major factors are used to calculate the soil loss for a given area. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion in that area. The USLE for estimating average annual soil erosion is expressed as:

$$A = R \times K \times LS \times C \times P$$

where:

A = average annual soil loss in tons per acre

R = rainfall erosivity index

K = soil erodibility factor

LS = topographic factor - L is for slope length and S is for slope

C = crop/vegetation and management factor

P = conservation practice factor

Evaluating the factors in USLE:

R - Rainfall Erosivity Index

The rainfall erosivity index describes the kinetic energy generated by the frequency and intensity of the rainfall. It is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, times its maximum 30-minute intensity. This index varies with geography.

K - Soil Erodibility Factor

This factor quantifies the cohesive or bonding character of the soil and its ability to resist detachment and transport during a rainfall event. The soil erodibility factor is a function of soil type.

LS - Topographic Factor

The topographic factor represents the effect of slope length and slope steepness on erosion. Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. For convenience L and S are frequently lumped into a single term.

C - Crop/Vegetation and Management Factor

The crop/vegetation and management factor represents the effect that ground cover conditions, soil conditions and general management practices have on soil erosion. It is the most computationally complicated of USLE factors and incorporates the effects of: tillage management, crop type, cropping history (rotation), and crop yield.

P - Conservation Practice Factor

The conservation practice factor represents the effects on erosion of Best Management Practices (BMPs) such as contour farming, strip cropping and terracing.

Estimates of the USLE parameters, and thus the soil erosion as computed from the USLE, are provided by the Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) 1994. The NRI database contains information of the status, condition, and trend of soil, water and related resources collected from approximately 800,000 sampling points across the country.

The soil losses from the erosion processes described above are localized losses and not the total amount of sediment that reaches the stream. The fraction of the soil lost in the field that is eventually delivered to the stream depends on several factors. These include, the distance of the source area from the stream, the size of the drainage area, and the intensity and frequency of rainfall. Soil losses along the riparian areas will be delivered into the stream with runoff-producing rainfall.

Sediment Modeling Methodology

Using WCS and the Sediment Tool, average annual sediment loading to surface waters was modeled according to the following procedures:

1. A WCS project was setup for the watershed that is the subject of these TMDLs. Additional data layers required for sediment analysis were generated or imported into the project. These included:

DEM (grid) - The Digital Elevation Model (DEM) layers that come with the basic WCS distribution system are shapefiles of coarse resolution (300x300m). A higher resolution DEM grid layer (30x30m) is required. The National Elevation Dataset (NED) is available from the United States Geologic Survey (USGS) website and the coverage for the watershed (8-digit HUC) was imported into the project.

Road - A road layer is needed as a shape file and requires additional attributes such as road type, road practice, and presence of side ditches. If these attributes are not provided, the Sediment Tool automatically assigns default values: road type - secondary paved roads, side ditches present and no road practices. This data layer was obtained from ESRI for areas in the watershed.

Soil - The Soil Survey Geographic Database (SSURGO) soil data (1:24k) may be imported into the WCS project if higher-resolution soil data is required for the estimation of potential erosion. If the SSURGO soil database is not available, the system uses the State Soil and Geographic Database (STATSGO) soil data (1:250k) by default.

MRLC Land Use - The Multi-Resolution Land Characteristic (MRLC) data set for the watershed is provided with the WCS package, but must be imported into the project.

2. Using WCS, the entire watershed was delineated into subwatersheds corresponding to USGS 12-digit Hydrologic Unit Codes (HUCs). These delineations are shown in Figure 4. All of the sediment analyses were performed on the basis of these drainage areas. Land use distribution for the impaired subwatersheds is summarized in Appendix C.

The following steps are accomplished using the WCS Sediment Tool:

3. For a selected watershed or subwatershed, a sediment project is set up in a new view that contains the data layers that will be subsequently used to calculate erosion and sediment delivery.
4. A stream grid for each delineated subwatershed was created by etching a stream coverage, based on National Hydrology Dataset (NHD), to the DEM grid.
5. For each 30 by 30 meter grid cell within the subwatershed, the Sediment Tool calculates the potential erosion using the USLE based on the specific cell characteristics. The model then calculates the potential sediment delivery to the stream grid network. Sediment delivery can be calculated using one of the four available sediment delivery equations:
 - Distance-based equation (Sun and McNulty, 1998)
 $Md = M * (1 - 0.97 * D/L)$
 $L = 5.1 + 1.79 * M$
where: Md = mass moved from each cell to closest stream network (tons/acre/yr)
M = sediment mass eroded (ton)
D = least cost distance from a cell to the nearest stream grid (ft)
L = maximum distance that sediment with mass M (tons) may travel (ft)
 - Distance Slope-based equation (Yagow et al., 1998)
 $DR = \exp(-0.4233 * (L/100) * Sf)$
 $Sf = \exp(-16.1 * (r/L + 0.057)) - 0.6$
where: DR = sediment delivery ratio
L = distance to the stream (m)
r = relief to the stream (m)
 - Area-based equation (USDASCS, 1983)
 $DR = 0.417762 * A^{(-0.134958)} - 1.27097, \quad DR \leq 1.0$
where: DR = sediment delivery ratio
A = area (sq. miles)
 - WEEP-based regression equation (Swift, 2000)
 $Z = 0.9004 - 0.1341 * X - 0.0465 * X^2 + 0.00749 * X^3 - 0.0399 * Y + 0.0144 * Y^2 + 0.00308 * Y^3$
where: Z = percent of source sediment passing to the next grid cell
X = cumulative distance down slope (X > 0)
Y = percent slope in the grid cell (Y > 0)

The distance slope based equation (Yagow et al., 1998) was selected to simulate sediment delivery in the Clear Fork River Watershed.

6. The total sediment delivered upstream of each subwatershed "pour point" is calculated. The sediment analysis provides the calculations for six new parameters:

- Source Erosion - estimated erosion from each grid cell due to the land cover
- Road Erosion - estimated erosion from each grid cell representing a road
- Composite Erosion - composite of the source and road erosion layers
- Source Sediment - estimated fraction of the soil erosion from each grid cell that reaches the stream (sediment delivery)
- Road Sediment - estimated fraction of the road erosion from each grid cell that reaches the stream
- Composite Sediment - composite of the source and erosion sediment layers

The sediment delivery can be calculated based on the composite sediment, road sediment or source sediment layer. The sources of sediment by each land use type is determined showing the types of land use, the acres of each type of land use and the tons of sediment estimated to be generated from each land use.

7. For each subwatershed of interest, the resultant sediment load calculation is expressed as a long-term average annual soil loss expressed in pounds per year calculated for the rainfall erosivity index (R). This statistic is calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30-minute intensity.

Calculated erosion, sediment loads delivered to surface waters, and unit loads (per unit area) for subwatersheds that contain waters on the 2006 303(d) List as impaired for siltation and/or habitat alteration are summarized in Tables B-1, B-2, and B-3, respectively.

Table B-1 Calculated Erosion - Subwatersheds with Waterbodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130101__)	<i>EROSION</i>				
	Road	Source	Total	%Road	%Source
	[tons/yr]	[tons/yr]	[tons/yr]		
0506	12,138.6	55,734.5	67,873	17.9	82.1
0603	9,540.0	4,945.4	14,485	65.9	34.1

Table B-2 Calculated Sediment Delivery to Surface Waters - Subwatersheds with Waterbodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130101__)	<i>SEDIMENT</i>				
	Road	Source	Total	%Road	%Source
	[tons/yr]	[tons/yr]	[tons/yr]		
0506	6,264.7	26,099.5	32,364	19.4	80.6
0603	5,137.9	1,580.7	6,719	76.5	23.5

Table B-3 Unit Loads - Sub watersheds with Water bodies Impaired Due to Siltation/Habitat Alteration

HUC-12 Subwatershed (05130101__)	HUC-12 Subwatershed Area	<i>UNIT LOADS</i>			
		Erosion		Sediment	
		[tons/ac/yr]	[lbs/ac/yr]	[tons/ac/yr]	[lbs/ac/yr]
0506	34,364	1.975	3,950	0.942	1,884
0603	32,223	0.450	899	0.209	417

APPENDIX C

MRLC Land Use of Impaired Subwatersheds and Ecoregion Reference Site Drainage Areas

**Table C-1 Clear Fork River Watershed - Impaired Subwatershed Land Use
Distribution**

Land Use	Subwatershed (05130101__)			
	0506		0603	
	[acres]	[%]	[acres]	[%]
Deciduous Forest	26,212	76.3	25,863	80.3
Emergent Herbaceous Wetlands	35	0.1	0	0.0
Evergreen Forest	1,282	3.7	1,482	4.6
High Intensity Commercial/ Industrial/Transportation	133	0.4	78	0.2
High Intensity Residential	50	0.1	4	0.0
Low Intensity Residential	213	0.6	164	0.5
Mixed Forest	3,401	9.9	3,965	12.3
Open Water	72	0.2	29	0.1
Other Grasses (Urban/recreational)	115	0.3	23	0.1
Pasture/Hay	2,023	5.9	281	0.9
Quarries/Strip Mines/Gravel Pits	98	0.3	0	0.0
Row Crops	436	1.3	61	0.2
Transitional	23	0.1	271	0.8
Woody Wetlands	272	0.8	0	0.0
Total	34,364	100.0	32,223	100.0

**Table C-2 Level IV Ecoregion Reference Site Drainage Area Land Use
Distribution**

Land Use	Ecosite Subwatershed							
	Eco68a01		Eco68a03		Eco68a08		Eco68a13	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay	0	0.0	0	0.0	0	0.0	0	0.0
Deciduous Forest	1,427	38.4	3,536	32.7	46,284	46.8	4,070	45.5
Emergent Herbaceous Wetlands	0	0.0	0	0.0	0	0.0	1	0.0
Evergreen Forest	921	24.8	3,011	27.8	15,790	16.0	2,365	26.4
High Intensity Commercial/ Industrial/Transportation	0	0.0	2	0.0	176	0.2	0	0.0
High Intensity Residential	0	0.0	0	0.0	0	0.0	0	0.0
Low Intensity Residential	0	0.0	11	0.1	258	0.3	1	0.0
Mixed Forest	1,369	36.8	3,977	36.7	24,815	25.1	942	10.5
Open Water	0	0.0	0	0.0	73	0.1	9	0.1
Other Grasses (Urban/recreational)	0	0.0	3	0.0	236	0.2	0	0.0
Pasture/Hay	0	0.0	259	2.4	9,207	9.3	501	5.6
Quarries/Strip Mines/Gravel Pits	0	0.0	0	0.0	0	0.0	0	0.0
Row Crops	0	0.0	28	0.3	1,564	1.6	40	0.5
Transitional	0	0.0	0	0.0	501	0.5	725	8.1
Woody Wetlands	0	0.0	0	0.0	0	0.0	292	3.3
Total	3,718	100.0	10,828	100.0	98,904	100.0	8,947	100.0

**Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land
Use Distribution**

Land Use	Ecosite Subwatershed							
	Eco68a20		Eco68a26		Eco68a28		Eco69d01	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay	0	0.0	1	0.0	0	0.0	0	0.0
Deciduous Forest	4,550	61.6	58,385	52.7	10,209	63.7	1,162	71.8
Emergent Herbaceous Wetlands	0	0.0	8	0.0	0	0.0	0	0.0
Evergreen Forest	519	7.0	11,272	10.2	1,487	9.3	84	5.2
High Intensity Commercial/ Industrial/Transportation	3	0.0	553	0.5	21	0.1	0	0.0
High Intensity Residential	0	0.0	33	0.0	0	0.0	0	0.0
Low Intensity Residential	25	0.3	784	0.7	89	0.6	0	0.0
Mixed Forest	2,217	30.0	21,382	19.3	3,574	22.3	369	22.8
Open Water	0	0.0	940	0.8	1	0.0	0	0.0
Other Grasses (Urban/recreational)	10	0.1	716	0.6	44	0.3	0	0.0
Pasture/Hay	9	0.1	13,864	12.5	469	2.9	1	0.0
Quarries/Strip Mines/Gravel Pits	0	0.0	312	0.3	0	0.0	0	0.0
Row Crops	7	0.1	1,398	1.3	139	0.9	0	0.0
Transitional	48	0.6	456	0.4	3	0.0	0	0.0
Woody Wetlands	0	0.0	788	0.7	0	0.0	0	0.0
Total	7,388	100.0	110,890	100.0	16,036	100.0	1,615	99.8

**Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land
Use Distribution**

Land Use	Ecosite Subwatershed							
	Eco69d03		Eco69d04		Eco69d05		Eco69d06	
	[acres]	[%]	[acres]	[%]	[acres]	[%]	[acres]	[%]
Bare Rock/Sand/Clay	0	0.0	0	0.0	0	0.0	0	0.0
Deciduous Forest	4,161	93.3	7,294	92.1	1,979	93.2	8,060	90.2
Emergent Herbaceous Wetlands	0	0.0	0	0.0	0	0.0	0	0.0
Evergreen Forest	43	1.0	81	1.0	31	1.4	149	1.7
High Intensity Commercial/Industrial/Transportation	0	0.0	3	0.0	0	0.0	7	0.1
High Intensity Residential	0	0.0	0	0.0	0	0.0	0	0.0
Low Intensity Residential	0	0.0	0	0.0	0	0.0	0	0.0
Mixed Forest	225	5.0	437	5.5	100	4.7	569	6.4
Open Water	0	0.0	0	0.0	0	0.0	2	0.0
Other Grasses (Urban/recreational)	0	0.0	0	0.0	0	0.0	0	0.0
Pasture/Hay	15	0.3	8	0.1	3	0.1	28	0.3
Quarries/Strip Mines/Gravel Pits	0	0.0	65	0.8	0	0.0	71	0.8
Row Crops	1	0.0	1	0.0	0	0.0	0	0.0
Transitional	15	0.3	36	0.5	12	0.6	51	0.6
Woody Wetlands	0	0.0	0	0.0	0	0.0	0	0.0
Total	4,459	99.9	7,924	100.0	2,125	100.0	8,936	99.9

APPENDIX D

Sediment Loading Analysis Methodology for Development of TMDLs, WLAs, & LAs

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and instream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations) and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma \text{WLAs} + \Sigma \text{LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure. It should be noted, however, that as a result of a recent court decision, EPA has recommended that all TMDLs, WLAs, and LAs include “a daily time increment in conjunction with other temporal expressions that may be necessary to implement relevant water quality standards” (USEPA, 2007). The TMDLs and allocations developed in this document are in accordance with this guidance.

TMDL analyses are performed on a 12-digit hydrologic unit code (HUC-12) area basis for subwatersheds containing waterbodies identified as impaired due to siltation and/or habitat alteration on the 2006 303(d) List. HUC-12 subwatershed boundaries are shown in Figure 4.

Sediment Loading Analysis

Sediment loading analysis for waterbodies impaired due to siltation/habitat alteration in the Clear Fork River Watershed was conducted using the Watershed Characterization System (WCS) Sediment Tool. This ArcView geographic information system (GIS) based model is described in Appendix B and was utilized to develop TMDLs, WLAs for MS4s, and LAs for nonpoint sources according to the procedure described below:

Development of TMDLs

1. As stated in Section 4, the WCS Sediment Tool was used to determine sediment loading to Level IV ecoregion reference site watersheds. These are considered to be biologically healthy watersheds and serve as appropriate targets for TMDL development (ref.: Table 4). The targets are expressed as average annual instream sediment loads per unit drainage area (lbs/ac/yr).
2. The Sediment Tool was also used to determine the existing average annual instream sediment loads of HUC-12 subwatersheds containing one or more waterbodies identified as impaired due to siltation/habitat alteration on the State’s 2006 303(d) List (ref.: Tables B-1, B-2, & B-3). As with the ecoregion targets, the existing loads were normalized to subwatershed area.

3. The existing average annual instream sediment load of each impaired HUC-12 subwatershed was compared to the average annual instream sediment load of the appropriate reference (biologically healthy) watershed and an overall required percent reduction in instream sediment loading calculated:

$$(\text{Required Reduction})_{\text{Overall}} = \frac{(\text{Existing Load}) - (\text{Target Load})}{(\text{Existing Load})} \times 100$$

WLAs for Ready Mix Concrete Facilities and Mining Sites

4. In each impaired subwatershed, 5% of the ecoregion-based target load was reserved to account for WLAs for NPDES permitted Ready Mix Concrete Facilities (RMCFs) and mining sites. WLAs for these facilities were considered to be equal to existing NPDES permit limits, which are expressed as daily maximum TSS concentrations. The estimated existing loads from these facilities were verified to be less than the five percent reserved in each impaired HUC-12 subwatershed (see Appendix E). Any difference between these existing loads and the 5% reserved load provide for future growth and additional MOS.

WLAs for NPDES Regulated Construction Storm Water (CSW) Discharges

5. In each impaired subwatershed, a portion of the ecoregion-based target load was also reserved to account for WLAs for NPDES permitted storm water discharges from construction sites (see Appendix F). The *Environmental Assessment for Proposed Effluent Guidelines and Standards for the Construction and Development Category* (USEPA, 2002) states that the *Economic Analysis of the Final Phase II Storm Water Rule* (USEPA, 1999a), estimated that, “in the absence of controls, construction sites on average generate approximately 40 tons of TSS per acre per year. In addition the Phase II Economic Analysis estimated that properly designed, installed, and maintained erosion and sediment (E & S) control BMPs, in combination, can potentially achieve a 90 to 95 percent reduction in sediment runoff” (USEPA, 2002). Based on this, a technology-based WLA equal to 6,000 lbs/ac/yr was selected for NPDES permitted storm water discharges from construction sites. This WLA is interpreted as erosion from the construction site.

Note: The WLA was converted to the equivalent instream sediment load and normalized to the HUC-12 subwatershed area, in order to facilitate mass balance calculations (see Appendix F).

WLAs for MS4s and LAs for Nonpoint Sources

6. The allowable load for discharges from MS4s and nonpoint sources can be derived from the basic equation:

$$\text{TMDL} = \Sigma \text{WLAs} + \Sigma \text{LAs} + \text{MOS}$$

This equation can be expressed as:

$$\text{Load}_{\text{TMDL}} = \text{Load}_{\text{RMCF}} + \text{Load}_{\text{Mining}} + \text{Load}_{\text{CSW}} + \text{Load}_{\text{MS4}} + \text{Load}_{\text{NPS}} + \text{MOS}$$

Substituting:

$$\text{Load}_{\text{TMDL}} = (\text{Target}) (A_{\text{HUC12}})$$

$$\text{Load}_{\text{RMCF}} + \text{Load}_{\text{Mining}} = (0.05) (\text{Load}_{\text{TMDL}}) \quad [\text{ref.: Step 4}]$$

$$\text{Load}_{\text{CSW}} = (\text{Equiv. Load})_{\text{CSW}} (A_{\text{HUC12}}) \quad [\text{equivalent instream load, ref.: Step 5}]$$

$$\text{Load}_{\text{MS4}} = (\text{Unit Load})_{\text{MS4}} (A_{\text{MS4}})$$

$$\text{Load}_{\text{NPS}} = (\text{Unit Load})_{\text{NPS}} (A_{\text{NPS}})$$

$$\text{MOS} = 0, \text{ due to an implicit margin of safety}$$

Note: A unit load is defined as a load per unit area.

Noting that:

$$(\text{Unit Load})_{\text{MS4}} = (\text{Unit Load})_{\text{NPS}}$$

and

$$(A_{\text{MS4}}) + (A_{\text{NPS}}) = (A_{\text{HUC12}}) - (A_{\text{CSW}}) = (A_{\text{HUC12}}) (1 - \%_{\text{CSW}})$$

where:

$$(\%_{\text{CSW}}) = \text{Percent of HUC-12 subwatershed area considered to be disturbed by construction activities at any time (see Appendix F).}$$

The equation can be solved for the allowable unit load for MS4s and nonpoint sources:

$$(\text{Unit Load})_{\text{NPS,MS4}} = \frac{[(0.95) (\text{Target Load})] - (\text{Equiv. Load})_{\text{CSW}}}{(1 - \%_{\text{CSW}})}$$

Note: The unit loads for MS4s and nonpoint sources are applicable to the areas associated with these loading sources.

7. For each impaired HUC-12 subwatershed, WLAs for MS4s and LAs for nonpoint sources were considered to be the percent load reduction required to decrease the existing average annual instream sediment load to the allowable unit load for MS4s and nonpoint sources calculated in Step 6.

$$WLA_{MS4s} = LA_{LAs} = \frac{(\text{Existing Load}) - (\text{Unit Load})_{NPS,MS4}}{(\text{Existing Load})} \times 100$$

Daily Expression of TMDL, WLAs, & LAs

Current EPA guidance states that daily load expressions be included in TMDLs calculated using allocation time frames greater than daily (USEPA, 2007). In accordance with this guidance, daily expressions of TMDLs, WLAs, and LAs were developed for all impaired subwatersheds.

TMDLs

An allowable daily load for each impaired subwatershed was determined by dividing the appropriate average annual instream target load (Step 1) by the average annual precipitation for the subwatershed. A composite average annual precipitation for each subwatershed (Table D-1) was determined using a GIS coverage downloaded from the Natural Resources Conservation Service climate mapping website (USDA, 2007):

<http://datagateway.nrcs.usda.gov/>

The TMDL for each impaired subwatershed consists of: a) the required overall percent reduction in instream sediment loading and b) the allowable daily instream sediment load per unit area per inch of precipitation (lbs/ac/in. precipitation). TMDLs are summarized in Table D-2.

WLAs for Ready Mix Concrete Facilities and Mining Sites

WLAs for RMCFs and mining sites (Step 4) were considered to be equal to existing permit requirements, which, in each case, include daily maximum concentration limits.

WLAs for NPDES Regulated Construction Storm Water (CSW) Discharges

As with TMDLs, a daily expression of the WLA for construction storm water activities was derived by dividing the allowable erosion load (Step 5) by the average annual precipitation for the subwatershed. The construction storm water WLA for each impaired subwatershed consists of: a) the allowable technology-based average annual erosion load and b) the allowable daily erosion load per unit area per inch of precipitation (lbs/ac/in. precipitation).

WLAs for MS4s and LAs for Nonpoint Sources

A daily expression of the MS4 WLA and the LA for nonpoint sources was derived by dividing the allowable unit load (Step 6) by the average annual precipitation for the subwatershed. The MS4 WLA and LA for each impaired subwatershed consists of: a) the required percent reduction in instream sediment loading (Step 7) and b) the allowable daily instream load per unit area per inch of precipitation (lbs/ac/in. precipitation). Daily MS4 WLAs and LAs should be interpreted as per unit area of the MS4 or area addressed by the LA.

Example Calculation for Subwatershed 051301010603 - TMDL, WLAs, & LAs

Step 1 Target for Ecoregion 69d = 276.1 lbs/ac/yr [ref.: Table 4]

Step 2 Erosion Unit Load = 899 lbs/ac/yr [ref.: Table B-3]
Sediment Unit Load (Instream) = 417.0 lbs/ac/yr [ref.: Table B-3]
Subwatershed Area = 32,223 acres [ref.: Table C-1]

Step 3

$$(\text{Required Reduction})_{\text{Overall}} = \frac{(417.0 \text{ lbs/ac/yr}) - (276.1 \text{ lbs/ac/yr})}{(417.0 \text{ lbs/ac/yr})} \times 100 = 33.8\%$$

Step 4 (WLA)_{RMCF & Mining} = Existing Permit Requirements

Step 5 Percent of HUC-12 area disturbed (used for calculations) = 1.5% [ref.: Table F-1]
Equivalent instream sediment unit load = 41.8 lbs/ac/yr [ref.: Table F-1]

Step 6

$$(\text{Unit Load})_{\text{NPS,MS4}} = \frac{[(0.95) (276.1 \text{ lbs/ac/yr})] - (41.8 \text{ lbs/ac/yr})}{(1 - 0.015)} = 223.9 \text{ lbs/ac/yr}$$

Step 7

$$(\text{Required Reduction})_{\text{NPS,MS4}} = \frac{(417.0 \text{ lbs/ac/yr}) - (223.9 \text{ lbs/ac/yr})}{(417.0 \text{ lbs/ac/yr})} \times 100 = 46.3\%$$

Daily Expression of TMDL, WLAs, & LAs

Average annual precipitation = 51.9 in. precip./yr [ref.: Table D-1]

Note: Value for construction storm water (CSW) is site erosion, all other values are instream sediment at the pour point of the HUC-12 subwatershed.

TMDL: Daily Maximum Load = $\frac{(276.1 \text{ lbs/ac/yr})}{(51.9 \text{ in. precip./yr})} = 5.3 \text{ lbs/ac/in. precip.}$

Construction Storm Water (CSW):

$$\text{Daily Maximum Load} = \frac{(6,000 \text{ lbs/ac/yr})}{(51.9 \text{ in. precip./yr})} = 115.6 \text{ lbs/ac/in. precip.}$$

MS4s & Nonpoint Sources:

$$\text{Daily Maximum Load} = \frac{(223.9 \text{ lbs/ac/yr})}{(51.9 \text{ in. precip./yr})} = 4.3 \text{ lbs/ac/in. precip.}$$

Table D-1 Average Annual Precipitation for Impaired Subwatersheds

HUC-12 Subwatershed (05130101_____)	Annual Average Precipitation
	[in/yr]
0506	51.6
0603	51.9

Table D-2 TMDLs for Impaired Subwatersheds

HUC-12 Subwatershed (05130101_____)	Level IV Ecoregion	Target Load	Existing Load	TMDL *	
				Required Load Reduction	Daily Maximum Load
		[lbs/ac/yr]	[lbs/ac/yr]	[%]	[lbs/ac/in. precip.]
0506	69d	276.1	1,883.6	85.3	5.4
0603	69d	276.1	417.0	33.8	5.3

* Applicable to instream sediment at pour point of HUC-12 subwatershed.

Table D-3 WLAs for Construction Storm Water, WLAs for MS4s, & LAs

HUC-12 Subwatershed (05130101_____)	WLAs				LAs ^b	
	Construction Storm Water ^a		MS4s ^b		Required Load Reduction	Daily Maximum Load
	Annual Average Load	Daily Maximum Load	Required Load Reduction	Daily Maximum Load		
	[lbs/ac/yr]	[lbs/ac/in. precip]	[%]	[lbs/ac/in. precip]	[%]	[lbs/ac/in. precip]
0506	6,000	116.3	88.2	4.3	88.2	4.3
0603	6,000	115.6	46.3	4.3	46.3	4.3

Notes: a. Applicable as site erosion per acre disturbed.
b. Applicable as instream sediment at pour point of HUC-12 subwatershed.

APPENDIX E

Estimate of Existing Point Source Loads for NPDES Permitted Mining Sites

Determination of Existing Point Source Sediment Loads

Ready Mixed Concrete Facilities

RMCFs would normally be considered in the determination of existing point source sediment loads but there were no RMCFs in the Clear Fork River Watershed as of October 10, 2007.

Existing point source sediment loads for mining sites located in impaired HUC-12 subwatersheds were estimated using the methodologies described below.

Mining Sites

Existing loads for permitted mining sites are based on an assumed runoff from the site drainage area, the daily maximum permit limit for TSS, and the area of the HUC-12 subwatershed in which the mining site is located (ref.: Table E-1). Site runoff was estimated by assuming that one half of the annual precipitation falling on the site area results in runoff.

$$AAL_{\text{Mining}} = \frac{(A_d) (D_{\text{Max}}) (\text{Precip.}) (0.2266 \text{ lb-l/ac-in-mg}) (0.5)}{(A_{\text{HUC-12}})}$$

where: AAL_{Mining} = Average annual load [lb/ac/yr]
 A_d = Facility (site) drainage area [acres]
 D_{Max} = Daily maximum concentration limit for TSS [mg/l]
 Precip. = Average annual precipitation for watershed [in/yr]
 $A_{\text{HUC-12}}$ = Area of impaired HUC-12 subwatershed [acres]

Table E-1 Estimate of Existing Load - NPDES Permitted Mining Sites

HUC-12 Subwatershed (05130101____)	Subwatershed Area	Average Annual Precip.*	NPDES Permit No.	Site Drainage Area	Daily Max TSS Limit	Annual Average Load
	[acres]	[in/yr]		[acres]	[mg/l]	[lb/ac/yr]
0506	34,364	51.6	TN0042722	9.00	40	0.061
			TN0052493	3.25		0.022
			TN0066095	23.20		0.158
			TN0071714	46.00		0.313
0603	32,223	51.9	TN0063576	282.81		2.064
			TN0068918	179.60		1.311
			TN0070963	90.60		0.661
			TN0071145	489.20		3.571

* Ref.: USDA Geospatial Data Gateway (USDA, 2007)

Total Existing Point Source Loads for Impaired HUC-12 Subwatersheds

Estimated point source loads were summed for each impaired HUC-12 subwatershed and then compared to both existing and target subwatershed sediment loads (ref.: Table E-2).

Table E-2 Estimate of Existing Point Source Loads in Impaired HUC-12 Subwatersheds

HUC-12 Subwatershed (05130101__)	NPDES Permit No.	Facility Type	Average Annual Point Source Load	Existing Subwatershed Load	Point Source Percentage of Existing Load	Subwatershed Target Load	Point Source Percentage of Target Load
			[lb/ac/yr]	[lb/ac/yr]	[%]	[lb/ac/yr]	[%]
0506	TN0042722	Mining	0.061				
	TN0052493		0.022				
	TN0066095		0.158				
	TN0071714		0.313				
	Subwatershed 0506 Total			0.554	1,883.6	0.03	276.1
0603	TN0063576	Mining	2.064				
	TN0068918		1.311				
	TN0070963		0.661				
	TN0071145		3.571				
	Subwatershed 0603 Total			7.607	417.0	1.82	276.1

APPENDIX F

Waste Load Allocations for NPDES Permitted Construction Storm Water Sites

In the description of the WCS Sediment Tool in Appendix B, it was stated that model output consists of both erosion and sediment parameters. The composite erosion value is the estimated erosion from road and land cover, while the composite sediment parameter is the fraction of soil erosion from road and land cover that is delivered to the stream network. The composite sediment value for a subwatershed represents the instream sediment load at the “pour point” of the subwatershed. TMDLs, WLAs, and LAs are primarily developed from composite sediment values. WLAs assigned to construction storm water (CSW) sites are an exception, however, in that the WLAs are technology-based and interpreted as erosion from construction sites.

In the *Environmental Assessment for Proposed Effluent Guidelines and Standards for the Construction and Development Category* (USEPA, 2002), it is stated that

EPA’s methodology for estimating construction site pollutant loadings builds upon the methodology used in the *Economic Analysis of the Final Phase II Storm Water Rule* (USEPA, 1999).

The Phase II EA estimated that in the absence of any controls, construction sites on average generate approximately 40 tons of TSS per acre per year. In addition, the Phase II EA estimated that properly designed, installed and maintained erosion and sediment (E&S) control BMPs, in combination, can potentially achieve a 90 to 95 percent reduction in sediment runoff.

This indicates that TSS discharges from CSW sites with properly designed, installed, and maintained erosion and sediment control BMPs should range from 4,000 lbs/ac/yr to 8,000 lbs/ac/yr. An erosion load of 6,000 lbs/ac/yr was selected an achievable, technology-based WLA for construction activities.

In order to account for the WLA assigned to CSW sites, the following procedure was used (HUC-12 subwatershed 051301010603 used as an example):

1. The total disturbed area of all permitted construction storm water sites in an impaired subwatershed was determined from permit records and the percent of total subwatershed area disturbed calculated.

$$\%(A)_{\text{CSW}} = \frac{\Sigma A_{\text{CSW}}}{A_{\text{Subwatershed}}} \times (100)$$

For subwatershed 051301010603:

$$\%(A)_{\text{CSW}} = \frac{(183 \text{ acres})}{(32,223 \text{ acres})} \times (100) = 0.57\%$$

2. In order to account for the transitory nature of construction activities, the value used in subsequent calculations was estimated as follows:
 - a. For percent of total subwatershed area disturbed less than 1.25%, a value of 1.5% was used for subsequent calculations.
 - b. For percent of total subwatershed area disturbed equal to or greater than 1.25%, a value of 120% of the percent of total subwatershed area disturbed, rounded up to the nearest tenth of a percent was used for subsequent calculations.

The resulting value is considered to be a reasonable indication of subwatershed area under construction at any time. For subwatershed 051301010603, 1.5% was used.

3. The composite erosion and composite instream sediment loads calculated in Appendix B (Tables B-1 & B-2) were noted and the ratio of total subwatershed erosion to total instream sediment calculated. This ratio was considered to be representative for the entire subwatershed.

For subwatershed 051301010603:

$$\text{S/E Ratio} = \frac{(\text{Sediment Load})_{0603}}{(\text{Erosion Load})_{0603}} = \frac{(6,719 \text{ tons/yr})}{(14,485 \text{ tons/yr})} = 0.464$$

4. The erosion load due to CSW sites in the subwatershed, normalized to the subwatershed area, was derived from the subwatershed area, CSW WLA of 6,000 lbs/ac/yr, and percent of subwatershed area disturbed by construction activities (ref.: Step 2).

$$(\text{Erosion Load})_{\text{CSW}} = \frac{(\cancel{A}_{0603}) \times (\%_{\text{CSW}}/100) \times (\text{WLA}_{\text{CSW}})}{(\cancel{A}_{0603})}$$

For subwatershed 051301010603:

$$(\text{Erosion Load})_{\text{CSW}} = (0.015) \times (6,000 \text{ lbs/ac/yr}) = 90.0 \text{ lbs/ac/yr}$$

5. The erosion load due to construction activities calculated in Step 4 was converted to an equivalent instream sediment load (at the subwatershed "pour point") using the sediment to erosion ratio determined in Step 3.

$$(\text{Sediment Load})_{\text{CSW}} = (\text{Erosion Load})_{\text{CSW}} \times (\text{S/E Ratio})$$

For subwatershed 051301010603:

$$(\text{Sediment Load})_{\text{CSW}} = (90.0 \text{ lbs/ac/yr}) \times (0.464) = 41.8 \text{ lbs/ac/yr}$$

This value, the instream sediment load at the subwatershed "pour point" due to discharges from CSW sites, is used in the analysis procedure described in Section 7.1 to calculate WLAs for MS4s and LAs for nonpoint sources. Instream sediment loads for other impaired subwatersheds are summarized in Table F-1.

Table F-1 Determination of Instream Sediment Load Due to Discharges from Construction Storm Water Sites

Subwatershed (05130101__)	Subwatershed Area	CSW Disturbed Area	Actual CSW % (A_{CSW}/A_{SubWS})	1.2 x Actual CSW % (if Actual CSW % >1.25%)	Value Used for Calcs.	Instream Sediment Load	Erosion Load	Sediment to Erosion (S/E) Ratio	Erosion Load From CSW	Instream Sediment Load Due to CSW
	[acres]	[acres]	[%]	[%]	[%]	[tons/yr]	[tons/yr]		[lbs/ac/yr]	[lbs/ac/yr]
0506	34,364	0 ^a	0.00	N/A	1.5	32,364	67,873	0.477	90.0	42.9
0603	32,223	183 ^b	0.57	N/A	1.5	6,719	14,485	0.464	90.0	41.8

- a. Although there were no active construction storm water sites in HUC-12 subwatershed 051301010506 as of October 10, 2007, the WLA was developed for the subwatershed to account for future construction activities.
- c. The construction storm water disturbed acreage is based on disturbed acreage of 183 acres within the total estimated acreage of 2,000 acres at a resort under construction (TNR130041 Rarity Mountain Resort (Phase I residential, Phase II roads, other improvements, and a golf course)). If the estimated disturbed acreage is exceeded, the WLA and suitability of the site for coverage under the *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005) may be reevaluated.

Appendix G
Public Notice Announcement

**STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER POLLUTION CONTROL**

**PUBLIC NOTICE OF AVAILABILITY OF PROPOSED
TOTAL MAXIMUM DAILY LOADS (TMDLs) FOR SILTATION & HABITAT ALTERATION
IN THE
CLEAR FORK RIVER WATERSHED (HUC 05130101), TENNESSEE**

Announcement is hereby given of the availability of Tennessee's proposed Total Maximum Daily Loads (TMDLs) for siltation and habitat alteration in the Clear Fork River Watershed located in Northeast Tennessee. Section 303(d) of the Clean Water Act requires states to develop TMDLs for waters on their impaired waters list. TMDLs must determine the allowable pollutant load that the water can assimilate, allocate that load among the various point and nonpoint sources, include a margin of safety, and address seasonality.

Two waterbodies in the Clear Fork River Watershed are listed on Tennessee's final 2006 303(d) list as not supporting designated use classifications due, in part, to siltation and habitat alteration associated with septic tanks, abandoned mining, and an undetermined source. The TMDLs utilize Tennessee's general water quality criteria, ecoregion reference site data, land use data, digital elevation data, a sediment loading and delivery model, and an appropriate Margin of Safety (MOS) to establish reductions in sediment loading which will result in reduced in-stream concentrations and the attainment of water quality standards. The TMDLs require reductions in sediment loading of approximately 5% in the listed waterbodies.

The proposed siltation/habitat alteration TMDLs may be downloaded from the Department of Environment and Conservation website:

<http://www.state.tn.us/environment/wpc/tmdl/proposed.shtml>

Technical questions regarding this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

Mary Wyatt, Watershed Management Section
Telephone: 615-532-0714
e-mail: Mary.Wyatt@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
Telephone: 615-532-0656
e-mail: Sherry.Wang@state.tn.us

Persons wishing to comment on the TMDLs are invited to submit their comments in writing no later than December 26th, 2007 to:

Division of Water Pollution Control
Watershed Management Section
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1534

All comments received prior to that date will be considered when revising the TMDL for final submittal to the U.S. Environmental Protection Agency.

The TMDL and supporting information are on file at the Division of Water Pollution Control, 6th Floor, L & C Annex, 401 Church Street, Nashville, Tennessee. They may be inspected during normal office hours. Copies of the information on file are available on request.